CANOTIA
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Vascular Plants of Arizona: Cornaceae

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Canotia is named for *Canotia holacantha* Torr. (Celastraceae), a spiny shrub or small tree nearly endemic to Arizona. Illustration by Alandon Joe

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INDEX TO FAMILIES OF THE VASCULAR PLANTS OF ARIZONA

Published treatments (**in bold**) can be found in volumes 26, 27, 29, 30, 32, 33, and 35 of the *Journal of the Arizona-Nevada Academy of Science* (**JANAS**) or in subsequent volumes (1–15) of **CANOTIA**. Unbolded entries indicate families with no treatments published to date. Figure numbers refer to illustrations in the "Key to Families of Vascular Plants in Arizona" in **JANAS** 35(2). All Vascular Plants of Arizona treatments are available as pdf files online at (http://www.canotia.org/vpa_project.html).

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CORNACEAE DOGWOOD FAMILY

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Trees or shrubs. LEAVES opposite or less often alternate, simple, entire or denticulate, arcuately veined. INFLORESCENCES terminal, cymose, umbellate, or capitate, sometimes subtended by showy, petaloid bracts. FLOWERS actinomorphic, perfect, epigynous; calyx 4-lobed, adnate to the ovary; petals 0 or 4, distinct; stamens 4, alternate with the petals; pistil 1; ovary inferior, bicarpellate, bilocular, with 1 ovule per locule; style simple; stigma 1–4-lobed. FRUITS drupes. SEEDS 2 per stone.—11 genera, ca. 100 spp., mostly in n hemisphere.

Cornus L. Dogwood

Shrubs or small trees. LEAVES opposite in ours, simple, exstipulate, deciduous, the blades tapered at both ends. INFLORESCENCES congested, capitate, up to ca. 1.5 cm wide, (surrounded by 4 showy bracts up to 4 cm long), or as in ours diffuse, cymose, 2–5 cm wide (lacking showy bracts). FLOWERS small, ca. 1 cm across in ours; calyx basally connate; petals 4, valvate; stamens attached to the receptacle. FRUITS drupes, globose to ovoid.—ca. 50 spp.; n temperate regions (Latin: horn, from the hard wood).

Dogwoods are commonly cultivated as ornamentals for their autumnal foliage and large showy bracts found in some species, e.g., *Cornus florida* L.

Cornus sericea L. (silky). Redosier dogwood. Shrubs to 4 m tall. STEMS glabrate, reddish to purple when young, grayish green when older. LEAVES ovate, lanceolate, or elliptic, paler underneath, 2–8 cm long, 1–4 cm wide, 1.3–3 times as long as wide, with 4–7 pairs of veins. INFLORESCENCE cymose, lacking showy bracts. FLOWERS: petals 2–4 mm long; style 1–3 mm long. FRUIT white, 7–10 mm long, the stone with faces smooth or with ridges.—2 subspp.; ne, nc, w US; Can., Mex.

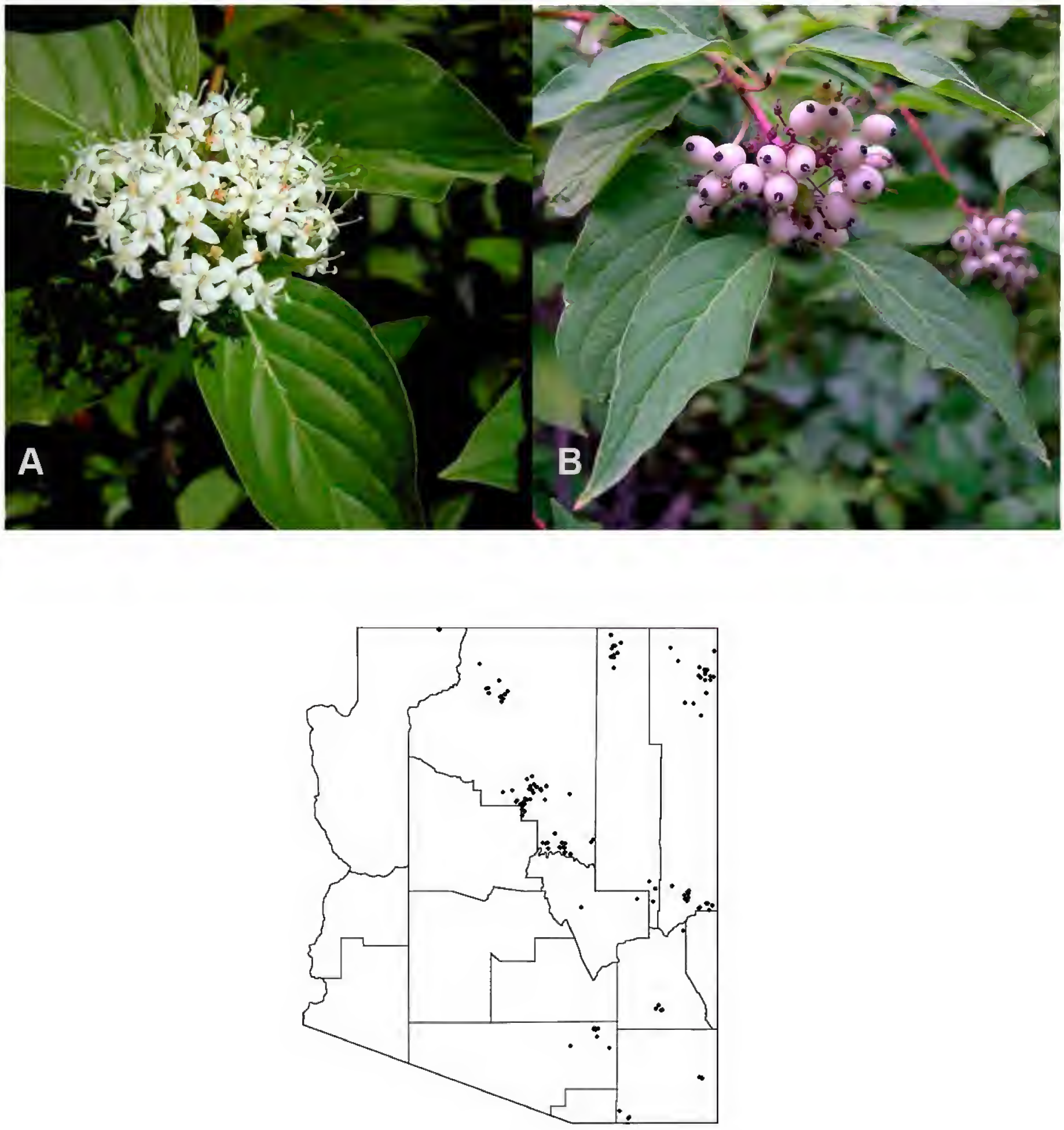
subsp. *sericea* (silky).—LEAVES abaxially glabrous or strigose. FLOWERS: petals 2-3 mm long; style 1–2 mm long. FRUITS: stone smooth on faces, furrowed on sides. [*Cornus alba* L., *C. baileyi* J. M. Coult. & Evans, *C. instolonea* A. Nelson, *C. interior* (Rydb.), N. Petersen, *C. stolonifera* Michx., *Swida instolonea* (A. Nelson) Rydb., *S. sericea* (L.) Holub, *S. stolonifera* (Michx.) Rydb.].—Riparian and canyon habitats; Apache, Cochise, Coconino, Gila, Graham, Pima, Mohave, Navajo cos.; 1200–2800 m (4000–9200 ft); May–Oct.

Cornus sericea subsp. *occidentalis* (Torr. & A. Gray) Fosb. is known from CA and NV, but has not been collected in AZ. It can be distinguished by having larger petals (3–4 mm), larger styles (2.5–3 mm), and having three ridges on the faces of the stones (Shevock 2016).

Vascular Plants of Arizona: Cornaceae. CANOTIA 15: 1–2. 2019. ©2019 Raul Gutierrez Jr.

LITERATURE CITED

SHEVOCK, J. R. 2016. *Cornus*, in Jepson Flora Project (eds.) *Jepson eFlora*, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=10016, accessed August 2016.



Cornaceae. Figure 1. *Cornus sericea* subsp. *sericea*. A. Inflorescence. B. Infructescence; fruits white, but appearing colored because of light in Oak Creek Canyon. Map of distribution. Photos by Max Licher.

HYDRANGEACEAE HYDRANGEA FAMILY

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Shrubs (in ours) often with shredding bark. LEAVES simple, opposite or fasciculate, sessile to petiolate, persistent or deciduous, entire or toothed, more or less hairy; stipules absent. INFLORESCENCES cymose, or of solitary flowers, bracteate, pedicellate. FLOWERS perfect (in ours), actinomorphic; hypanthium present; sepals 4–5, free (or fused at base); petals 4–5, free; stamens 8–12 (numerous in *Philadelphus*), free or united at the base; ovary 1/4 to 2/3 inferior; carpels 3–5, fused; placentation axile or parietal; styles 3–5, distinct or fused at base, usually persistent; stigmas along length of style or short, capitate. FRUIT a long persistent capsule, septicidal and/or loculicidal. Seeds one to numerous.—17 genera, ca. 237 spp., chiefly of north temperate and sub-tropical regions.

Hydrangea and *Philadelphus* are important cultivated ornamentals.

1. Leaves pinnately veined, frequently over 30 mm long, the margins dentate-crenate; petiole usually over 10 mm long; flowers 5-merous; capsules loculicidal. ..... *Jamesia*

1' Leaves palmately 3-veined or veins obscure, usually under 30 mm long, the margins entire; petiole usually less than 2 mm long; flowers usually 4-merous; capsules septicidal.

2. Flowers and fruit 3 to many in a cluster; petals 1.5–3 mm long; fruit 3–5 mm long. ..... *Fendlerella*

2' Flowers and fruit solitary, or rarely in groups of 2–3; petals 4–19 mm long; fruit 4–12 mm long.

3. Petals clawed; leaves coriaceous, usually concolorous; fruit 9–12 mm long..... ..... *Fendlera*

3' Petals not clawed; leaves submembranous, bicolorous, the lower surface densely covered with white hairs and therefore lighter; fruit 4–9 mm long..... *Philadelphus*

Fendlera Engelm. & A. Gray Fendler Bush

STEMS ascending or spreading; bark red to grey, often exfoliating; twigs glabrous or strigose with branched to unbranched hairs. LEAVES opposite or sometimes fasciculate; sessile to short-petiolate; blade linear to lanceolate or oblong, faintly 3-veined from base, hispid to strigose; margins entire, flat or revolute. FLOWERS solitary or in groups of 2–3, perfect; sepals 4; petals 4, clawed; stamens 8–12, the filaments broad and flat at base, distinct, the alternate filaments often shorter; ovary about one quarter inferior, 4-loculed; placentation axile; styles 4, distinct, persistent and spreading. FRUIT a septicidal capsule. SEEDS 1–3 per locule, fusiform, brown.—2–3 spp. in sw U.S. and Mex. (1 sp. in AZ) (named in honor of Augustus Fendler, 1813–1883, a Prussian botanist and explorer of the sw U.S.).

Fendlera rupicola Engelm. & A. Gray (cliff dweller). Fendler Bush—Shrubs to 2 m tall. LEAVES 10–27 mm long, 3–7 mm wide, sessile or subsessile. FLOWERS pedicellate;

Vascular Plants of Arizona: Hydrangeaceae, Hydrangea Family. CANOTIA 15: 3-13. 2019. © W. McBride, A. Prince, S. Holiday, T. Ridlinghafer, S. Skibicki, R. Scott, and T. Ayers

petals 10–16 mm long including claw, 6–11 mm wide. CAPSULES 9–12 mm long; styles 4–5 mm long. [*F. wrightii* (A. Gray) Heller].—Canyons and washes mostly in chaparral and pinyon-juniper woodland: Apache, Cochise, Coconino, Gila, Greenlee, Graham, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai cos.; 1100–2200 m (3500–7250 ft); Apr–Jun; AZ, CO, NM, TX, UT, n. Mex.

Billie Turner annotated specimens from Graham, Greenlee, and Pinal counties as *Fendlera wrightii.* Recognition of *Fendlera wrightii* as a distinct species or as a variety of *F. rupicola* is based on leaf hairs (Turner 2001). Freeman (2016) did not see any specimens of var. *wrightii* from Arizona and states that the variety is known only from New Mexico, Texas and northern Mexico. However, specimens from four different areas in Arizona (Grand Canyon, Verde Valley, Chiricahua Mountains, and White Mountains) have the hairs typical of var. *wrightii,* which is distinguished by two layers of hairs on the abaxial surface—a lower layer of branched minute hairs and an upper layer of longer strigose, appressed hairs. The adaxial surface is densely pubescent. This subspecific taxon is not recognized here because the hairs are difficult to see without at least 40X magnification and are found on specimens widely spread across the state and in close association with specimens lacking these hairs.

Leaf color and venation may help distinguish narrow-leafed vegetative specimens of *Fendlera rupicola* and *Philadelphus microphyllus*. *Fendlera rupicola* usually has concolorous leaves and obscured secondary and tertiary veins, while *P. microphyllus* has bicolorous leaves with secondary and tertiary veins often visible.

Fendlerella (Greene) A. Heller Utah Fendlerbush

STEMS ascending or spreading; bark gray, often exfoliating; twigs glabrous or hispid to strigose with unbranched hairs. LEAVES opposite or sometimes fasciculate, sessile to short-petiolate, the blade lanceolate, elliptic to obovate, faintly 3-veined from base, strigose; margins entire, flat or revolute. INFLORESCENCE a many-flowered terminal cluster. FLOWERS 3 to many; sepals 4–5; petals 4–5, white, without a claw; stamens 8–12, the filaments broad and flat at the base, the alternate filaments often shorter, distinct; ovary about one quarter inferior, 3-loculed; placentation axile; styles 3, distinct. FRUIT a septicidal capsule; styles persistent and spreading; seeds 1 per locule, fusiform-ellipsoid, brown.—3 spp. in sw U.S. and Mex. (1 sp. in AZ) (Genus *Fendlera* and Latin -*ella*, diminutive).

Fendlerella utahensis (S. Watson) A. Heller (from Utah). Utah Fendlerbush, Yerba Desierto—Shrubs to 1 m tall. LEAVES 4–30 mm long, (1–)2–6(–10) mm wide, sometimes in fascicles, sessile or subsessile. FLOWERS pedicellate; petals 1.5–3 mm long, 0.5–1 mm wide. CAPSULES 3–5 mm long, 1–2 mm wide; style 1.0–1.3mm long. – Canyon rims to steep canyon slopes: Cochise, Coconino, Graham, Greenlee, Mohave, Pima, Santa Cruz, Yavapai cos.; 1,100–3,050 m (3,600–10,000 ft); May–Aug; AZ, CA, CO, NM, NV, TX, UT, Mex. (Chih., N.L.).

This taxon is easily separated from *Fendlera rupicola* by the inflorescence (many-flowered terminal clusters) versus solitary axillary flowers in *F. rupicola*. Vegetative specimens may be confused with *F. rupicola* but are easily separated by the presence of distinctly pustulate hairs on the abaxial surface of the leaves in this taxon (versus strigose hairs mostly lacking pustulate bases in *F. rupicola*.)

Regional floras have recognized two varieties, var. *utahensis* and var. *cymosa*. Variety *cymosa,* with relatively narrower, longer and acute leaves, was reported from the mountains of southern Arizona (Freeman 2016), but specimens with these leaf characteristics have also been found in lower elevations in the Grand Canyon and may represent adaptations to hotter, drier habitats. We found considerable variation in leaf size and shape, even within populations. Common garden experiments may be useful in establishing whether these varieties merit recognition.

Jamesia Torr. & A. Gray Cliffbush

STEMS ascending; bark reddish-brown, peeling in paper-like sheets with a gray or tan layer below; twigs glabrous or with unbranched hairs. LEAVES opposite, petiolate, the blade ovate to circular, pinnately-veined; margins dentate to crenate with apiculate teeth, flat. INFLORESCENCES cymose, many-flowered. FLOWERS 7–35; sepals 5; petals 5, without a claw; stamens 10, the filaments broad and flat at base, distinct; ovary about half inferior, 3–5-loculed, becoming 1-loculed; placentation parietal; styles 3–5, persistent. FRUIT a loculicidal capsule. SEEDS many, fusiform, brown.—2 spp. in w U.S. and n Mex. (1 sp. in AZ) (for Edwin P. James, 1797–1861, American botanist, geologist, geographer, and explorer of sw U.S.).

Jamesia americana Torr. & A. Gray (of the American continent). Cliffbush.—Shrubs to 3 m tall. LEAVES with petioles (3–)10–30(–43) mm long; blades 18–103 mm long, 10–83 mm wide; upper surface green and strigose; lower surface white to gray, pilose to canescent-wooly. FLOWERS long-pedicellate; petals 6–10 mm long, 3–6 mm wide, strigose. CAPSULES 2–8 mm long, 2–5 mm wide; styles up to 7 mm long.— 4 vars.; AZ, CA, CO, NM, NV, UT, WY, n Mex.

var. *americana*— Rocky slopes, moist soils; Cochise, Graham, Pima, cos.: 2130–3267 m (7000–10720 ft); May–Aug. AZ, CO, NM, WY, n Mex.

Jamesia americana var. *zionis* N. H. Holmgren & P. K. Holmgren has been found in sw UT near the AZ state line. It should be searched for in northern Mohave County. Variety *zionis* can be distinguished by pale brown to gray bark that peels into strips or flakes (versus reddish brown bark that peels in sheets in var. *americana*) and 4–12-flowered inflorescences (versus 7–35-flowered inflorescences in var. *americana*).

Philadelphus L. Mock-orange

STEMS spreading to arching; bark red-brown, aging gray, sometimes peeling; twigs glabrous or hispid to strigose with unbranched and often pustulate hairs. LEAVES opposite, short-petiolate, the blade narrowly lanceolate to ovate, 3-veined from base, the apex acute to obtuse; margins entire, flat to revolute. FLOWERS solitary; sepals 4; petals 4, without a claw; stamens 20+, the filaments flattened and sometimes united at the base; ovary inferior to half inferior, 4-loculed, placentation axile; styles 4, distinct to united, persistent. FRUIT a septicidal capsule. SEEDS numerous per locule, fusiform, brown—ca 18–50 spp. widely distributed in n hemisphere. (1 sp. in AZ) (Greek *philos*, love; *adelphos*, brother; thought to be named for the Greek king of Egypt, Ptolemy II Philadelphus).

Philadelphus microphyllus A. Gray (small-leaved). Littleleaf Mock-orange—Shrubs to 3 m tall. LEAVES 5–40 mm long, 3–20 mm wide; petiole 0–2 mm long. FLOWERS

pedicellate; sepals 3–6(–7) mm long, glabrous to hairy, ovate to acuminate; petals 4–19 mm long, widely elliptic. CAPSULES 4–9 mm long.—Pinyon, juniper, and oak woodlands in dry, rocky canyons and crevices: Apache, Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Pima, Santa Cruz cos.; 1065–3000 m (3500–9800 ft); May-Aug. AZ, CA, CO, NM, NV, UT, TX, WY, n to c Mex.

This notably variable species has been subject to widely different treatments. Kearney & Peebles (1969) recognized five subspecies of *P. microphyllus* (ssp. *argenteus* (Rydb.) C. L. Hitchc., ssp. *argyrocalyx* (Wooton) C. L. Hitchc., ssp. *occidentalis* (A. Nels.) C. L. Hitchc., ssp. *stramineus* (Rydb.) C. L. Hitchc., and ssp. *typicus* A. Gray) based on the number of stamens, the degree to which the filaments are united, pubescence types on leaf surfaces and the calyx, and the size of leaves and petals. Hu (1956) used many of these same characters to recognize seven species (*P. argenteus* Rydb., *P. crinitus* (Hitchc.) Hu, *P. maculatus* (Hitchc.) Hu, *P. madrensis* Hemsl., *P. microphyllus*, *P. occidentalis* A. Nels., and *P. palmeri* Rydb.) from Arizona. A review of specimens, including many of those cited by Dr. Hu, does not reveal any consistent pattern that warrants recognition of these species. Examination of populations in different parts of Arizona have revealed similar subtle variation of pubescence within populations.

In his review of *Philadelphus*, Hitchcock (1943) noted that "it is largely a matter of interpretation whether these other entities be considered varieties, subspecies, or species, but certain characteristics upon which Rydberg based his species appear to be but normal variations largely accountable for by habitat. Still other differences which were used to characterize some of the segregates are not at all constant even though they may be genetic in origin, so that the maintenance of some of Rydberg's species, even as subspecific entities, does not seem feasible." Our review of *Philadelphus* specimens from Arizona further supports a wide range of variation in calyx and leaf pubescence within populations. Freeman (2016) recognizes two Arizona varieties, vars. *microphyllus* and *madrensis* based on leaf vestiture, flower number, and capsule size. He notes that the leaves of var. *microphyllus* are sparsely sericeous-strigose adaxially, inflorescences are 1(–3)-flowered, and capsules 4.4–6 mm long, while var. *madrensis* leaves are sparsely to moderately strigose-sericeous adaxially, inflorescences 1–3(–5)-flowered, and capsules are 5–8 mm long. Because the variation is continuous without a distinct geographic or elevational pattern, we chose not to recognize these subspecific taxa.

LITERATURE CITED

FREEMAN, C. 2016. Hydrangeaceae. For: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 18+ vols. New York and Oxford. Vol. 12.

HELLER, A. A. 1898. New and interesting plants from western North America. Bulletin of the Torrey Botanical Club 25(12): 626–629.

HITCHCOCK, C. L. 1943. The xerophilous species of *Philadelphus* in southwestern North America. Madroño: 7: 35–56.

HOLMGREM, N. H., and P. K. HOLMGREN. 1997. Hydrangeaceae in Intermountain Flora, vol.3 part A. pp 5–12. New York Botanical Garden, Bronx, New York.

HU, S. 1955. A monograph of the genus *Philadelphus*. Journal of the Arnold Arboretum 36: 52–109.

HU, S. 1956. A monograph of the genus *Philadelphus*. Journal of the Arnold Arboretum 37: 15–90.

RYDBERG, P. A. 1905. *Philadelphus*, in N. Amer. Fl. 22: 162–175.

TURNER, B. L. 2001. Taxonomic revision of the genus *Fendlera* (Hydrangeaceae). Lundellia 4:1–11.

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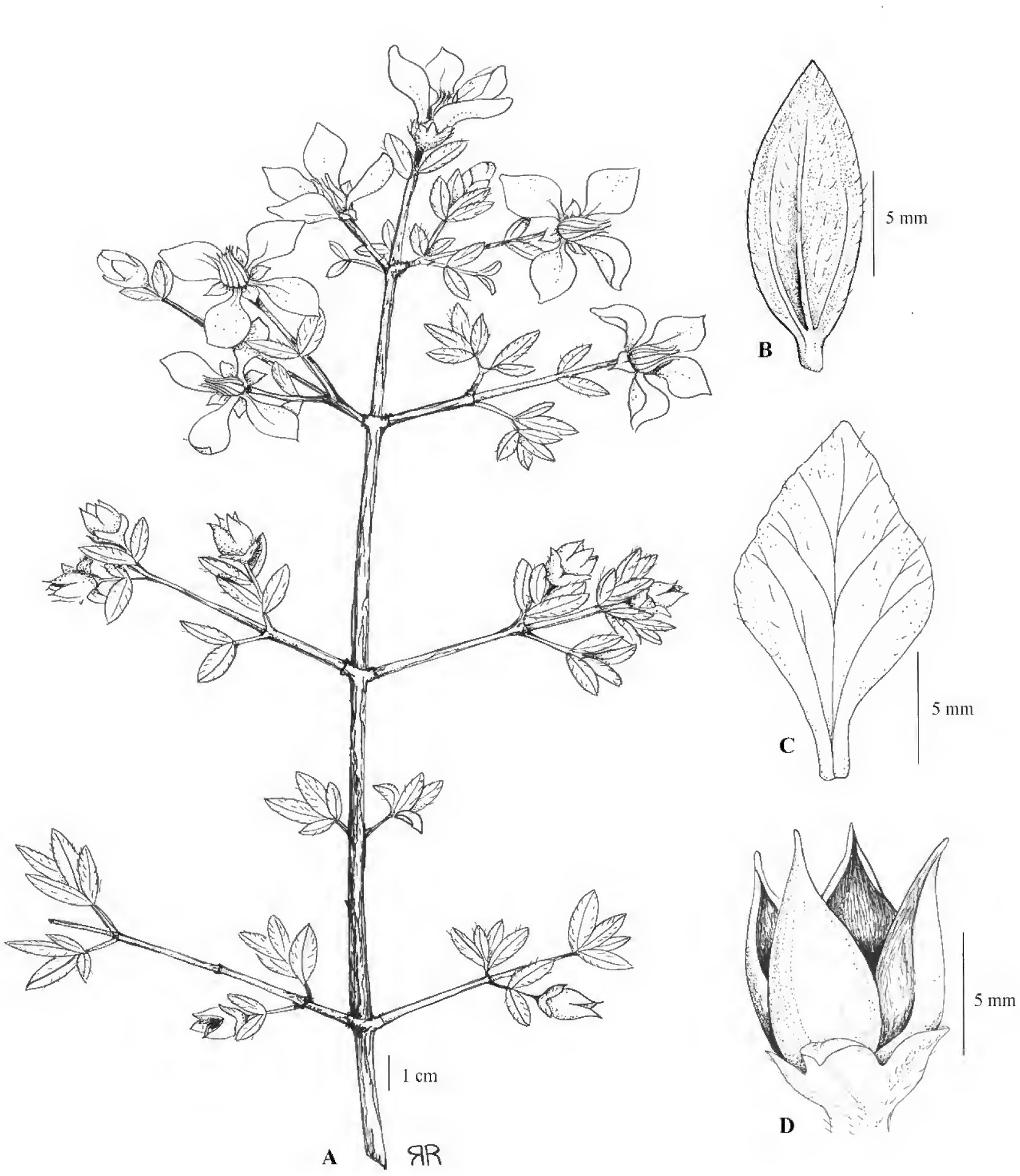
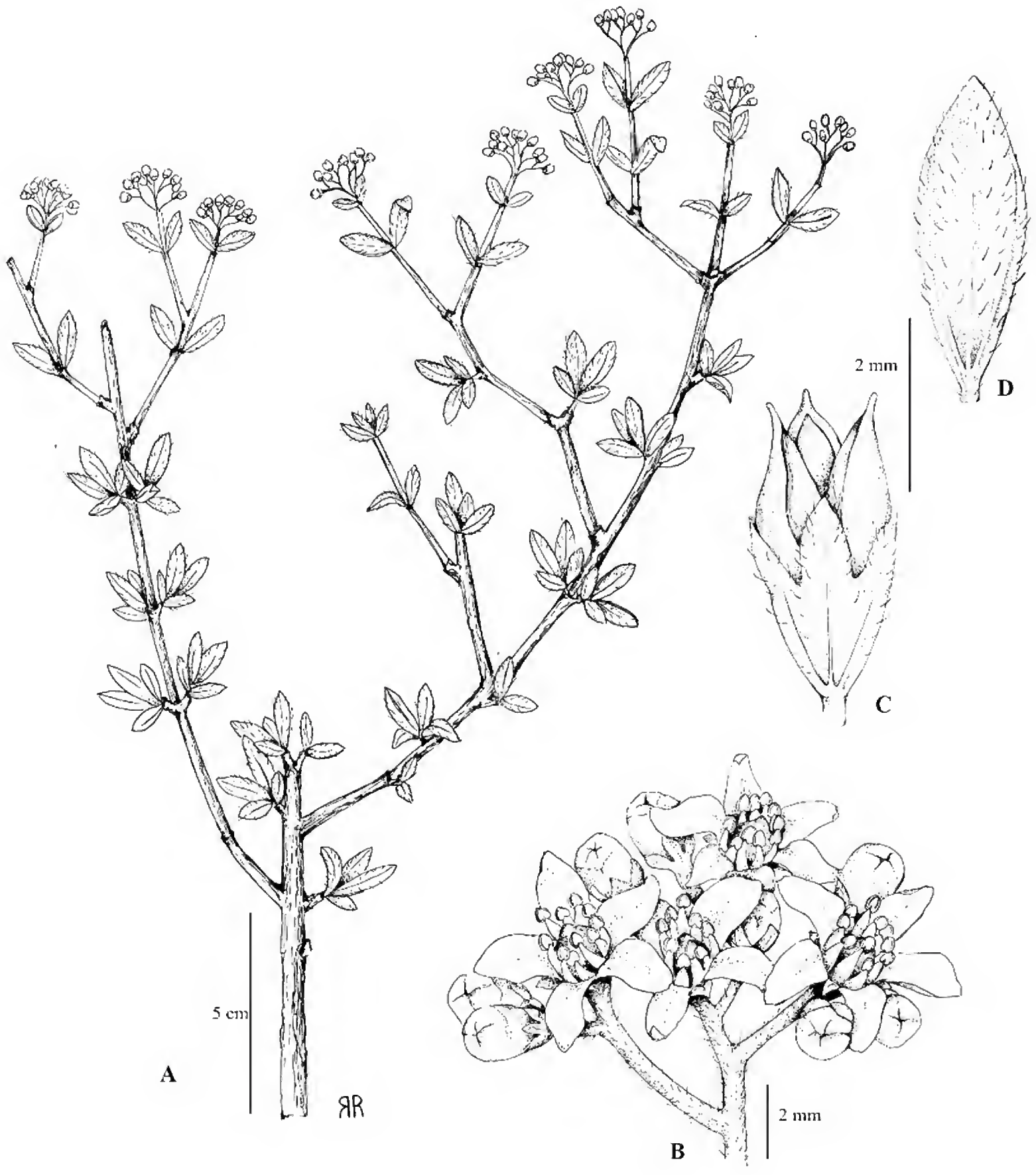
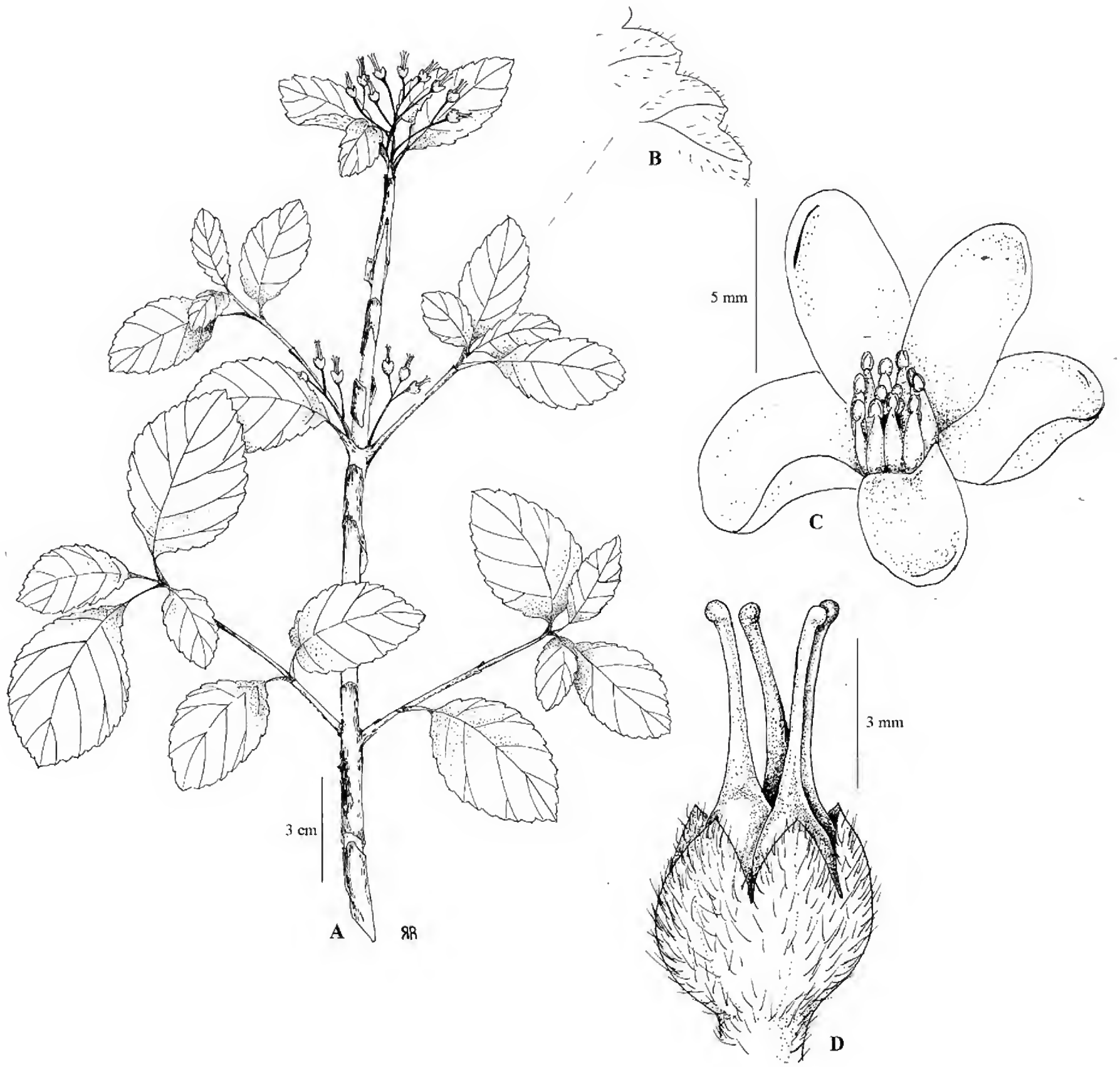


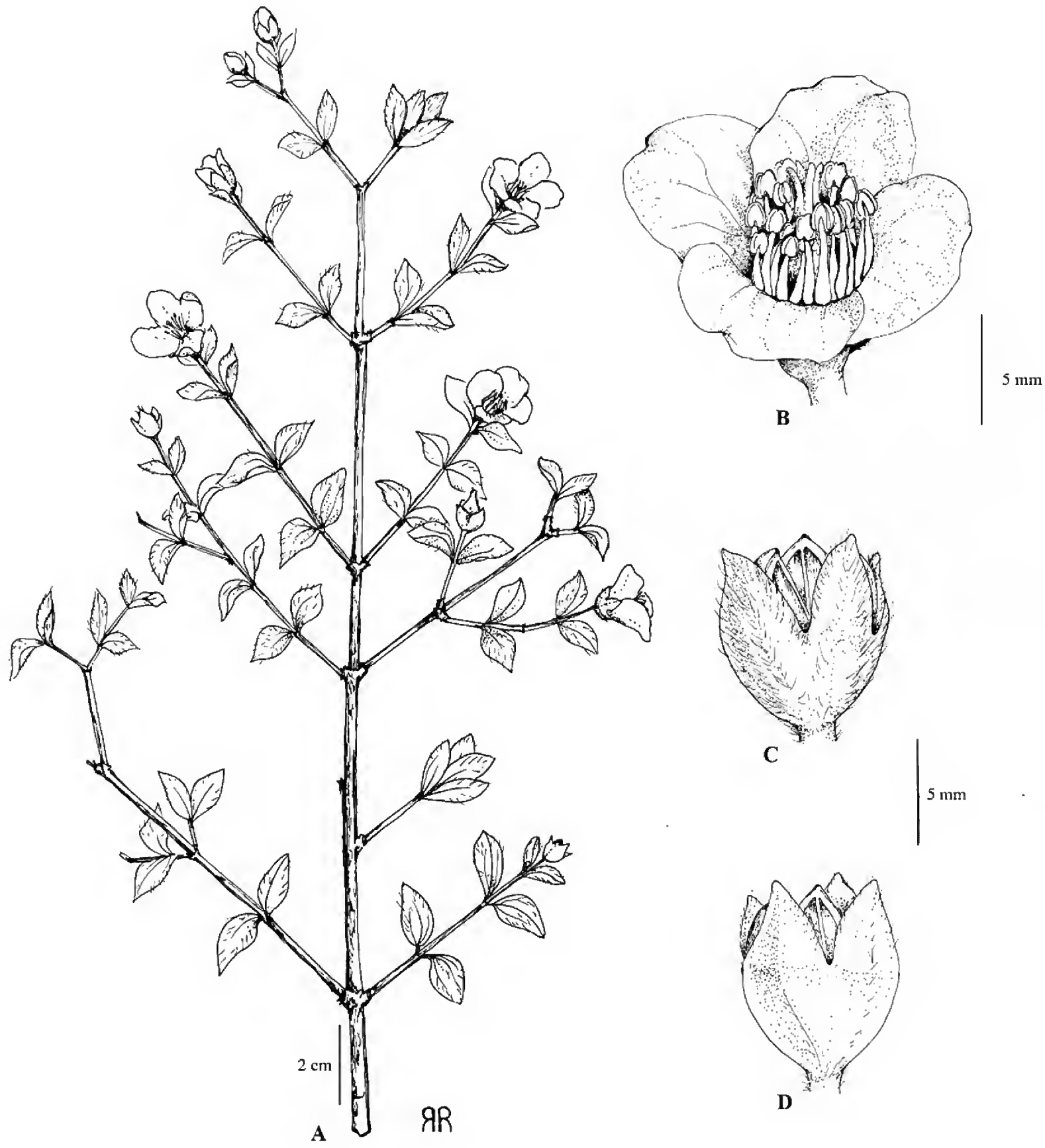
Hydrangeaceae. Figure 1. *Fendlera rupicola.* (A) habit; (B) leaf; (C) petal; (D) capsule. Illustration by Rachael Rubin.



Hydrangeaceae. Figure 2. *Fendlerella utahensis.* (A) habit; (B) inflorescence; (C) fruit; (D) leaf, abaxial surface. Illustration by Rachael Rubin.

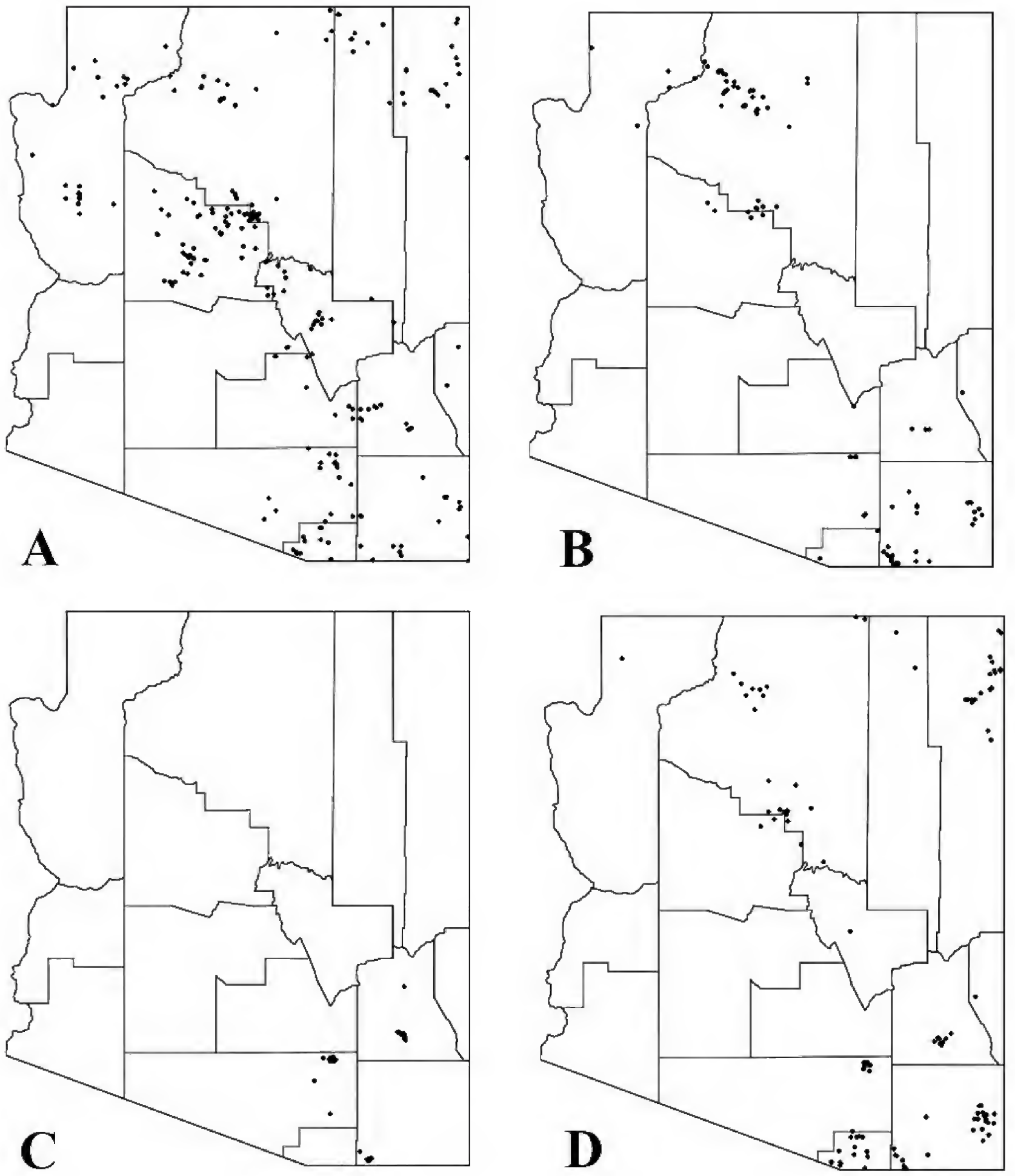


Hydrangeaceae. Figure 3. *Jamesia americana* . (A) habit; (B) leaf margin; (C) flower; (D) immature fruit. Illustration by Rachael Rubin.



Hydrangeaceae. Figure 4. *Philadelphus microphyllus*. (A) habit; (B) flower; (C) capsule with pubescent hypanthium; (D) capsule with almost glabrous hypanthium. Illustration by Rachael Rubin.

Hydrangeaceae. Figure 5. (A-C) *Fendlera rupicola*; (D-E) *Fendlerella utahensis*; (F-G) *Jamesia americana*; (H-I) *Philadelphus microphyllus*. (all photos by Max Licher)



Hydrangeaceae. Figure 6. Distribution of: (A) *Fendlera rupicola*; (B) *Fendlerella utahensis*; (C) *Jamesia americana*; (D) *Philadelphus microphyllus*.

JUNCACEAE RUSH FAMILY

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Perennial or annual graminoid herbs, cespitose or rhizomatous, with fibrous roots. CULMS usually round, sometimes compressed in cross section, pith-filled, pith-chambered, fiber-filled, or hollow, with or without leaf-producing nodes. LEAVES simple, alternate or spirally arranged, basal or basal and cauline, in some species reduced to bladeless sheaths (cataphylls) only; sheath open or closed, usually auriculate, the auricles rarely joined to form a ligule; blades linear, parallel-veined, flat, channeled, or terete in cross section, entire or with ciliate leaf margins. INFLORESCENCE terminal, sometimes appearing lateral, cymose, determinate, composed of clusters of flowers or single flowers arranged in panicles, racemes, or corymbs, sometimes compressed into a compact head, usually subtended by one or more leaf-like bracts, each inflorescence branch having 1–2 additional bracts. FLOWERS subtended by 0–2 reduced translucent smaller bracts (bracteoles), perfect (in ours); perianth radially symmetric, of 6 herbaceous to scarious tepals in 2 ranks (whorls), persistent; ovary superior; stamens 3 or 6 (in ours); anthers basifixed, persistent; stigmas 3. FRUIT a capsule, dehiscent, unilocular with 1 basal placenta or 3-locular with axile or parietal placentas. SEEDS 3 or many (in ours), outer seed coat hyaline, sometimes forming basal and apical appendages. —7 genera, ca. 440 species (2 genera & 30 species in Arizona), worldwide. *Juncus* are predominantly in wet sites, but most *Luzula* taxa are in mesic to more xeric habitats (though exceptions exist for both). Both are primarily found in arctic and temperate regions and are mostly restricted to mountains in the tropics. There are no known human uses of rushes for food or medicine, however they are frequently used to make baskets and matting, e.g., the fine covering of Japanese tatami mats is woven from the fibers of *Juncus effusus*. A South American high elevation species (*Distichia muscoides*) more or less woody, forming mounds and cushions, is cut into chunks and used for fuel by indigenous peoples.

In this treatment we use round parentheses ( ) to denote measurements or character states that we have observed in AZ specimens that are less common. We use square parentheses [ ] to denote more extreme measurements or character states reported for specimens outside of AZ, but not yet observed in AZ specimens. In the keys, we use the most obvious, or most reliable character as the first phrase of the key, with less obvious or less reliable characters in following phrases. In considering whether leaves are basal or cauline, remember that all leaves have sheaths that attach to the culm at nodes. If a culm lacks nodes, the leaves are all basal; if the culm has nodes, those nodes give rise to leaves that are cauline.

For this study we have reviewed over 3500 specimens. We made numerous field trips to

Vascular Plants of Arizona: Juncaceae Rush Family. CANOTIA 15: 14–64. 2019. © M. Licher and G. Rink.

re-locate and verify important or questionable collections, and many of these trips added new locations for uncommon taxa in the state. We were able to locate in the field all but two species (*Juncus bryoides* and *J. cooperi*). We made new collections and Licher made photographs of *Juncus* and *Luzula* species at most sites that we visited. Many of these photos are posted on the SEINet (2018) website.

Key to the Genera

1. Leaves glabrous, or blades absent; capsules with numerous seeds (in ours) bracteoles when present entire; sheaths open in most species (*Juncus effusus* group with "sealed" or "closed" sheaths) ..... ***Juncus***
1' Leaves ciliate, with hairs at least on the basal margins; capsules with three seeds; bracteoles sub-entire to lacerate or fringed; sheaths closed ..... ***Luzula***

Juncus L. Rush

Plants grass-like, glabrous, perennial, or less frequently annual; perennial plants densely cespitose, from short rhizomes, to colonial, from long-creeping rhizomes; annual plants cespitose, fibrous rooted. CULMS generally round in cross section, sometimes flattened, pith-filled, fiber-filled, or hollow, with or without nodes. LEAVES simple, alternate or spirally arranged, clustered at the base or basal and cauline; bladeless basal sheaths (cataphylls) present or not, diagnostic in some groups/species; sheaths open from the base, with hyaline or scarious margins, these often prolonged at the top, forming auricles, sometimes confluent forming a ligule; blades lacking or well-developed, when present linear, with or without crosswalls (septate or not), channeled or involute or terete or flat with face towards the culm (grass-like) or flat with the edge towards the culm (ensiform, *Iris*-like). INFLORESCENCES terminal, though appearing lateral in some species due to the erect proximal bract appearing like a continuation of the culm, cymose, diffuse to congested, sometimes with one to many racemose or paniculate clusters (heads or glomerules); branches and clusters with or without bracts; proximal inflorescence bract flat or terete, shorter to much longer than the inflorescence, or sometimes reduced to a scale, sometimes appearing like a continuation of the culm. FLOWERS perfect, with or without two bracteoles (bractlets, or prophylls in some texts) immediately subtending the perianth; perianth of six tepals in 2 whorls, the perianth parts small, greenish to purplish-brown or almost black, usually persistent at fruiting; stamens 3 or 6 (in ours)(when 3, always above the outer tepals); filaments shorter to longer than the anthers; ovary superior; stigmas 3. CAPSULES either 3-locular or 1-locular, containing many minute seeds. SEEDS ellipsoid to ovoid, sometimes with slender appendages (tails) at one or both ends. —ca. 315 species worldwide, ca. 95 listed in the Flora of North America, 26 in AZ. (from the classical name for the plants: *jonc*). Principal references: Brooks & Clemants (2000a), Kirschner (2002), Zika (2012).

Juncus specimens are best collected in fruit. Stamen characteristics are also sometimes critical for accurate determinations. Handily, stamens are persistent in fruit. For many species, it is important to include underground parts for a complete collection.

Juncus is divided into two subgenera and ten sections, eight of which are present in AZ. Previous keys to subgenera in *Juncus* treatments (Brooks & Clemants 2000, Kirschner 2002) have used the presence or absence of bracteoles as an important character. However, it

is often difficult to differentiate bracteoles from other bracts subtending the flowers or the branches in a highly condensed inflorescence. We provide a key to the subgenera and sections of *Juncus*, with species present in AZ listed, followed by a key to the species, based on more readily observable stem and leaf traits for AZ *Juncus*.

Key to subgenera and sections of *Juncus*

1. Flowers usually in heads or clusters, rarely single; bracteoles absent at the base of each flower, **subgenus *Juncus***
   2. Plants annual; inflorescence a single terminal flower (in ours), **sect. *Caespitosi*** Cout. (go to couplet 2 in key to species) ***Juncus bryoides***
   2' Plants perennial; inflorescence a panicle with many flowers.
      3. Leaf blades terete.
         4. Leaf blades without crosswalls (not septate), tips pungent; plants densely cespitose; inflorescence bract stiff and eventually terete, sometimes appearing as a continuation of the culm, **sect. *Juncus*** (go to couplet 20 in key to species) ***Juncus acutus, J. cooperi***
         4' Leaf blades with crosswalls (septate), tips not pungent; plants rhizomatous to cespitose; inflorescence bracts various, but not usually appearing as a continuation of the culm, **sect. *Ozophyllum*** Dumort (go to couplet 15 in key to species) ***Juncus acuminatus, J. articulatus, J. brevicaudatus, J. nevadensis, J. nodosus, J. torreyi***
      3' Leaf blades flat.
         5. Leaf blades ensiform (flat with edge towards stem, Iris-like) ***sect. Iridifolii*** Snogerup & Kirschner (go to couplet 5 in key to species) ***Juncus saximontanus, J. xiphioides***
         5' Leaf blades with face towards stem. **sect. *Graminifolii*** Engelm. (go to couplet 7 in key to species) ***Juncus longistylis, J. macrophyllus, J. marginatus***
1' Flowers borne singly (sometimes on very short pedicels in a loose cluster), two bracteoles present at the base of each flower, **subgenus *Poiophylli*** Buchenau
   6. Plants annual; leaf nodes basal and cauline, **sect. *Tenageia*** Dumort. (go to couplet 2 in key to species) ***Juncus bufonius***
   6' Plants perennial; leaf nodes basal (in ours).
      7. Inflorescence bract cylindric, resembling continuation of culm; inflorescence appearing lateral; leaf blades present or absent, terete, **sect. *Juncotypus*** Dumort. (go to couplet 21 in key to species) ***Juncus balticus, J. drummondii, J. effusus, J. exiguus, J. laccatus, J. mexicanus***
      7' Inflorescence bract not cylindric, not resembling continuation of culm (though sometimes strongly ascending and longer than the inflorescence); inflorescence appearing terminal; leaf blades present, flat with face toward stem, sometimes inrolled, rarely terete, **sect. *Steriochloa*** Griseb. (go to couplet 9 in key to species) ***Juncus confusus, J. dichotomus, J. dudleyi, J. interior, J. tenuis***

Key to the species of *Juncus* in Arizona

1. Plants annual; either up to 30 cm tall with inflorescence length at least 40% of total plant height, or less than 3 cm tall with only one flower per culm.
   2. Inflorescence a single terminal flower; culm unbranched, less than 3 cm tall, 0.1–0.2 mm thick; leaves all basal, less than 1 cm long; inflorescence bract lacking……..
   ..... ***Juncus bryoides***
   2’ Inflorescence a terminal panicle of several to many flowers; culm branched, 2-30 cm tall, 0.2–1 mm thick; leaves basal and cauline, 3-13 cm long, inflorescence bract leaf-like
   ..... ***Juncus bufonius***
1. Plants perennial; usually taller than 25 cm (though shorter individuals may be found); inflorescence length less than 40% of total plant height.
   3. Leaf blades flat, channeled, or involute.
      4. Leaf blades flat in cross-section with an edge toward culm (*Iris*-like); blades partially septate.
         5. Capsule ellipsoid, subobtuse, mucronate; leaves generally 2–5 mm wide; perianth brown to green, rarely red-tipped; inflorescence usually with less than 50 heads
         ..... ***Juncus saximontanus***
         5’ Capsule narrowly prismatic-trigonous, acuminate to narrowly acute; leaves generally 5–14 mm wide; perianth green, usually red-tipped; inflorescence usually with more than 50 heads ..... ***Juncus xiphioides***
      4’ Leaf blades flat in cross-section with the face toward culm (grass-like), channeled or involute; blades not septate.
         6. Leaves both basal and cauline (culms with nodes), the blades nearly flat in cross-section; flowers borne in obconic clusters on the branches of the inflorescence; pairs of bracteoles lacking below each flower.
            7. Tepals 2-3 mm long; capsules nearly globose, 1.8–2.9 mm long; stamens 3; inflorescence heads 10–200; bladeless sheaths lacking at base of culm; leaves to 5 mm wide ..... ***Juncus marginatus***
            7’ Tepals 3.8–6 mm long; capsules obovoid, (2.6-)3–5 mm long; stamens 6; inflorescence heads 1–20(-40); bladeless sheaths present on at least some culm bases; leaves to 3 mm wide.
               8. Plants rhizomatous; rhizomes with internodes between culms of up to 5 cm long, light (rarely dark) brown; sheaths dull brownish, to 5 cm long; culms usually smooth below the inflorescence; inflorescence heads 1–8(–12); tepals 5.0–6.0 mm long, typically with brown bands on either side of a green (brown) midstripe, not reddish tipped ..... ***Juncus longistylis***
               8’ Plants loosely cespitose; rhizomes with internodes between culms of up to 1 cm long, dark brown; sheaths pale grayish to brownish, often with pinkish tinge, to 10 cm long; culms minutely scabrous below the inflorescence; inflorescence heads (4–)8–20(–40); tepals 3.8–5.5 mm long, sometimes with narrow tan bands on either side of a pale greenish midstripe, often reddish tipped ..... ***Juncus macrophyllus***
         6’ Leaves all basal (culms without nodes), the blades sometimes flat, often channeled to involute in cross-section; flowers borne singly on the branches of the inflorescence; pairs of bracteoles present below each flower.

9. Inflorescence congested, 1-2.5 cm long; tepals with brown midvein, bordered with dark green to blackish stripes, the margins membranous (in immature specimens, the lateral stripes can be very light, but are often thickened or have a different texture than the central stripe); mature capsules 2.5–3.5 mm long, strongly retuse, lacking a mucro, top of the valve partitions with sharp ridges, the capsules with 3 chambers; anthers 0.3–0.5 mm long; plants of springs, lakes and wet meadows from 2350-2800 m (7800-9100 ft.); n AZ ..... ***Juncus confusus***

9' Inflorescence open (only appearing congested when immature), 1–9 cm long; tepals green to reddish in color; mature capsules 2.2–4.7 mm long, rounded to obtuse to truncate, usually with a mucro (persisting style base), top of the valve partitions not sharp-ridged, the capsules with a single chamber, the locular partitions separated except at base; anthers 0.1–1.0 mm long; plants of diverse habitats, from 500-2900 m (1600-9500 ft.); various habitats and ranges.

10. Auricles generally 1–6 mm long (often broken or missing), wholly thin, membranous, transluscent throughout, the tips generally acute to acuminate (late season growth can have shorter auricles); culm with strong ridges, with weak ridges between the strong ones (when dried); anthers (0.2–)0.4–0.7 mm long ..... ***Juncus tenuis***

10' Auricles 0.2–0.6 mm long, from wholly thick and opaque to partially opaque below and becoming thinner and scarious at the margins and tip, the tips rounded to acute; culm typically with strong ridges visible on each side and no weak ridges (when dried); anthers 0.4–1.2 mm long.

11. Auricles wholly thick, often plastic-like, rounded, shiny, when mature and dried yellowish to the tips; tepals 4–6 mm long; anthers 0.6–1.0 mm long ..... ***Juncus dudleyi***

11' Auricles thick at the base to thinner and often scarious at the margins and tips (though sometimes inrolled and appearing thick), when mature and dried not shiny or yellowish or thick to the tips; tepals 3–5.2(–5.5) mm long; anthers 0.4–1.2 mm long.

12. Plants usually coarser, greater than 60 cm tall; bases rarely pinkish; tepals [3–]4.5–5.2(–5.5) mm long; anthers 1.0–1.2 mm long; bracteoles acute; auricles often not symmetrical, often inrolled; in AZ only known from the Huachuca Mts. ..... ***Juncus dichotomus***

12' Plants usually finer, less than 60 cm tall; bases frequently pinkish; tepals 3.0–3.8(–4.4) mm long; anthers 0.4–0.6(–1.0) mm long; bracteoles acuminate to attenuated; auricles usually symmetrical, rarely inrolled; widespread in AZ ..... ***Juncus interior***

3' Leaf blades round (can be compressed somewhat, but not flat) in cross section, or lacking.

13. Leaves both basal and cauline (culms with nodes), the blades septate.

14. Most mature heads in an inflorescence globose to subspherical (flowers in mature heads spreading equally in all directions); flowers greenish to tan or light brown; capsules lance-subulate to narrowly ovoid, the apices acute; plants rhizomatous with occasional tuberous thickened nodes.

15. Plants 10–40 cm tall; leaf blades erect to ascending; auricles 0.2-1.7 mm long; tepals 2.4-4.1 mm long, inner tepals slightly longer (to slightly shorter) than the

outer; all tepals shorter than the capsules; lower leaves sometimes bladeless; stamens 3 or 6 ..... ***Juncus nodosus***

15' Plants 15-90 cm tall; leaf blades stiffly divaricate; auricles 2–5 mm long; tepals 4–5 mm long, the inner tepals shorter than the outer ones; all tepals subequal to the capsules; leaves all with blades; stamens 6 ..... ***Juncus torreyi***

14' Most mature heads in an inflorescence hemispherical, ellipsoid, obconic to obpyramidal (flowers in mature heads mostly spreading or ascending to erect), sometimes globose to subspherical (but then fewer flowers reflexed than pointing in other directions); flowers variously colored; capsules ovoid, ellipsoid, or prismatic, the apices acuminate, acute to rounded or truncate; plants cespitose or rhizomatous, if rhizomatous, tuberous nodes lacking.

16. Stamens 3 [6]; plants cespitose; anthers less than or equal to filaments.

17. Tepals and capsules 3-4 mm long; capsules less than or equal to the tepals; flowering heads hemispherical to subspherical with (3–)5–50 spreading to reflexed flowers per head; auricles 0.4-2.5 mm long; seeds not tailed, the seed tips blunt or with a tiny mucro less than 0.1 mm long ..... ***Juncus acuminatus***

17' Tepals 2.3-3.2 mm long; capsules 4-4.2 mm long, significantly longer than the tepals; flowering heads elliptic to obconic with 2–8 ascending flowers per head; auricles 0.4-1 mm long, seeds tailed, the tails 0.1-0.3 mm long ..... ***Juncus brevicaudatus***

16' Stamens 6; plants somewhat rhizomatous (may not be obvious); anthers less than or greater than filaments.

18. Tepals 1.8-3.0 mm long; capsules 2.8-4.1 mm long, exserted; flowering heads obconic to hemispherical with 3-5 ascending to spreading flowers per head; anthers less than (equal to) filaments; plants appearing cespitose from densely interpenetrating rhizomes..... ***Juncus articulatus***

18' Tepals 2.4-4.0 mm long; capsules 2-3.7 mm long, subequal to the tepals; flowering heads broadly obconic to subspherical with 3-60 spreading to reflexed flowers per head; anthers greater than or equal to filaments; plants strongly rhizomatous, with single culms or small clusters spaced along the rhizomes. ..... ***Juncus nevadensis***

13' Leaves all basal (culms without nodes), the blades not septate, or lacking.

19. Leaf blades terete, pungent tipped; flowers borne mostly in small clusters (occasionally a single flower on an inflorescence branch); without pair of bracteoles at the base of each flower; restricted to desert springs and washes with perennial moisture.

20. Capsules nearly globose, much longer than the perianth, 2.4–3.3 mm wide; tepals 2.2–2.8 mm long; culms 2.5-5 mm thick..... ***Juncus acutus***

20' Capsules ellipsoid, equal to or up to 1 mm longer than the perianth, 1.6–2.0 mm wide; tepals 4–5 mm long; culms 1–3 mm thick..... ***Juncus cooperii***

19' Leaf blades lacking or somewhat compressed terete, not pungent tipped; flowers borne singly (or several close together in *J. balticus*); with pair of bracteoles at the base of each flower; plants of diverse habitats.

21. Plants in loose colonies, the culms scattered or in lines; rhizomes long with apparent internodes; capsules ovoid, the apices rounded to acute, the mucro 0.2–0.8 mm long.
    22. Blades well developed on some upper sheaths, more than 5 cm long, culm-like; culms up to 2 mm thick; culms and leaf blades often compressed, often helical (loosely corkscrew shaped) ..... ***Juncus mexicanus***
    22' Blades lacking or vestigial, less than 1 cm long, not culm-like; culms (0.7)2–4 mm thick; culms and leaves rarely slightly compressed, rarely helical ..... ***Juncus balticus***
21' Plants in dense tufts like bunchgrass, the culms cespitose; rhizomes short with no apparent internodes; capsules obovoid (narrowly ellipsoid in *J. drummondii*), the apices retuse or truncate, the mucro lacking or up to 0.2 mm long.
    23. Inflorescence with 2–5 flowers; stamens 6; plants up to 40 cm tall; tepals 4.5–7[–8] mm long; alpine ..... ***Juncus drummondii***
23' Inflorescence with more than 5 flowers; stamens 3; plants 25–150 cm tall; tepals 1.5–3.6 mm long; not alpine.
    24. Upper sheaths with asymmetrical scarious wings on the symmetrical shoulders either side of the awn (see image guide), (scarious wings often damaged or missing on older specimens), the sheaths lighter brown with only slight darkening, the base rusty brown to pinkish or salmon colored (our subspecies) ..... ***Juncus effusus***
    24' Upper sheaths lacking scarious wings on the symmetrical shoulders either side of the awn, the sheaths usually dark brown throughout or near the tip, the base brown to greenish.
        25. Upper sheaths thin at the tips, the upper margin sometimes slightly bent to inrolled towards the stem, dull, pale, tips pale to dark brown, the veins prominent and converging gradually to the tips..... ***Juncus exiguus***
        25' Upper sheaths thickened at the tips, the upper margin not rolled under, glossy, dark brown to blackish throughout, tips often darker, the veins obscure and converging abruptly to the tips..... ***Juncus laccatus***

Juncus acuminatus Michaux (acuminate, possibly for the shape of the capsule apices) Sharp-fruited rush.—Plants perennial, cespitose. CULMS terete, 14–90[–100] cm tall, 1–3 mm thick; cauline leaf producing nodes present. BLADELESS SHEATHS 0(–2), brown or red, the margins often hyaline, the tips rounded to acute. LEAVES both basal and cauline, basal 1-2, cauline 1-2; basal sheaths often reddish; auricles 0.4–2.5 mm long, rounded, scarious; blades terete, hollow, 1–40 cm long, 0.6–2.5 mm wide, perfectly septate with crosswalls visible externally, pale green, the tips acute to acuminate. INFLORESCENCE terminal, (1–)4–12[–15] cm long, generally open, composed of (1–)3–25[–50] heads on ascending to spreading branches; heads hemispheric to globose, (3–)5–30(–50)-flowered, 6–10 mm wide, each head with short branches, each branch with a scarious, awn-tipped basal bract; proximal inflorescence bract leaf-like, terete, erect, 1–12 cm long, shorter to longer than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals lanceolate, 3.0–3.5(–4.0) mm

long, green fading to straw colored, the margins scarious, the tips acuminate, often red; inner tepals shorter than to subequal to the outer tepals; stamens 3(-6); filaments 0.8–1.5 mm long; anthers 0.4–0.8 mm long, 1/3 to equal filament length. CAPSULES ovoid, broadest below the middle, narrowing and trigonous toward apices, imperfectly 3-locular, [2–]3.0–3.2(–4) mm long, 0.6–1.0 mm wide, shorter than to nearly equaling the tepals, brown, the apices acute to rounded, the mucro about 0.2 mm long. SEEDS ellipsoid to oblong in outline, 0.4 mm long, 0.2 mm wide, yellow-brown, reticulate with raised veins, the ends apiculate, not tailed. 2n = 40.—Stream banks and lakeshores, rocky streambeds, springs, wet meadows, swamps, and open wetlands: Apache, Cochise, Coconino, Gila, Graham, Navajo, Pima, and Santa Cruz cos; 800–2400 m (2700–7900 ft.); Apr–Aug; throughout e U.S., with scattered disjunct populations in the n Great Plains and in the w states; extreme s Can.; Mex. to Honduras. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus acuminatus has a somewhat disjunct range in AZ; it is found in Ponderosa Pine and Mixed Conifer Forest from the Flagstaff area along the Mogollon Rim to the White Mts. It also occurs in the Sonoran Desert Scrub in the canyons of the Santa Catalina and Rincon mountains near Tucson, and in Madrean Oak Woodland near the Mex. border. It has been confused with both *Juncus nevadensis* and *J. articulatus*, both terete-leaved species in SECTION *Ozophyllum*. Both are rhizomatous, though the rhizomes may be difficult to discern in *Juncus articulatus*. *Juncus nevadensis* capsules are broadly elliptic to obovoid, generally widest above the middle, while those of *J. acuminatus* are widest below the middle, narrowing upwards. Also, the anthers of *J. nevadensis* are 0.5-1.2 mm long, while those of *J. acuminatus* are 0.4-0.8 mm long, although there is overlap in the given ranges, the anthers of *J. acuminatus* are typically smaller than those of *J. nevadensis*. *Juncus articulatus* typically has smaller, fewer-flowered heads that are hemispheric to obconic, tepals with broadly acute tips, and capsules that are exserted, while the heads in *Juncus acuminatus* are usually larger (they can occasionally be as small), with many more flowers, and range from hemispherical to globose, with tepals having more narrowly acuminate tips, and capsules that are usually shorter than the tepals. *Juncus articulatus* is also more rhizomatous (although it usually forms clumps), and frequently has slightly decumbent culms, while those of *Juncus acuminatus* are strictly erect. *Juncus acuminatus* might be confused with *Juncus torreyi* or *J. nodosus*, both also in SECTION *Ozophyllum,* which also have terete, septate leaves, and inflorescences of globose clusters. However, *Juncus torreyi* and *J. nodosus* are both strictly rhizomatous, with tuberous nodes on the rhizomes; both have subulate capsules and flowers in mature heads spreading equally in all directions, whereas *J. acuminatus* has capsules that are ovoid with acute apices and flowers in mature heads mostly spreading or ascending to erect.

Juncus acutus L. (from acute, for the sharp-tipped leaves) Spiny rush.—Plants perennial, cespitose, robust, densely tufted, often forming clumps to 1 m wide. CULMS terete, 0.6–1.5 m tall, 2.5–5.0 mm wide; cauline leaf producing nodes lacking. BLADELESS SHEATHS 1–2. LEAVES all basal, usually 2–4 per culm; sheaths shiny brown, with scarious margins that taper to a common fused point at base of blade; blades terete, 30–100 cm long, 2–3 mm wide, not septate, the tips pungent. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 10–30 cm long, with unequal branches; composed of 30–100 glomerules on unequal, ascending or arching branches in several to many clusters; glomerules with 2–5 flowers each; each branch and glomerule subtended by 1 or 2 hyaline, red-spotted bract(s); proximal inflorescence bract distally terete, usually shorter than

inflorescence, the tips pungent. FLOWERS lacking a pair of bracteoles; tepals 2.2–2.8 mm long, straw-colored, red-spotted or red-streaked, the tips brown; outer tepals widely lanceolate, the margins scarious, the tips obtuse to acute; inner tepals rounded, shorter or longer than the outer tepals; stamens 6; filaments 0.2–0.4 mm long; anthers 1.2–1.8 mm long. CAPSULES nearly globose, imperfectly 3-locular, 3.2–4.5 mm long, 2.4-3.3 mm wide, greatly exceeding perianth, yellow-brown, smooth and shiny, acute with a mucro 0.2-0.4 mm long. SEEDS obliquely obovoid, the body 0.6–0.7 mm long, dull to glossy, brownish, coarsely reticulate veined, tailed, the tails 0.2–0.3 mm long. —2 subsp., only subsp. ***leopoldii*** (Parlatore) Snogerup in the U.S., which differs from subsp. *acutus* in having capsules with an obtuse rather than conical apex.—Desert washes with perennial moisture, alkaline seeps and springs: Coconino, La Paz, Mohave, Yavapai, and Yuma cos.; 50–1000 m (100–3300 ft); Apr–Aug; CA, NV; Mex. (Baja C.); S. Amer.; S. Africa; Atlantic Islands. SUBGENUS *Juncus*; SECTION Juncus.

Juncus acutus is unique among rushes in AZ in its robust size and pungent tipped leaves. *Juncus cooperi* grows in similar habitats, but in AZ, is far less common than *J. acutus* and is a slightly smaller species, with less rigidly pungent leaves and longer, more aristate tepals.

Juncus articulatus L. (from the Latin, *articulatus*, meaning composed of segments united by joints, referring to the branching structure of the inflorescence) Jointed rush.—Plants perennial, but sometimes appearing annual, usually forming clumps, from densely branching, interwoven, stout rhizomes; rhizomes 1–3 mm in thick. CULMS terete, [5–]10–60[–100] cm tall, 0.5–1.8 mm thick, smooth to longitudinally ridged, erect, or less often decumbent; cauline leaf producing nodes present. BLADELESS SHEATHS 0–1(-2), 1–3 cm long, maroon to straw-colored, the tips rounded to acute with a short awn. LEAVES both basal and cauline, basal 0–2, and cauline (1–)3–6; sheaths pale green to reddish, hyaline margined; auricles 0.5–1 mm long, rounded, scarious; blades terete, hollow, 3.5–20 cm long, 0.5–1.8 mm wide, perfectly septate, with crosswalls visible externally, pale green, the tips acute and brown, not pungent. INFLORESCENCE terminal, (1–)3–8(–12) cm long, generally open, composed of 3–20[–50] heads on spreading branches; heads 3–5[–10] flowered, 2–6(–12) mm wide, obconic to hemispheric, often with short branches, each branch with a scarious, awn-tipped bract; proximal bract leaf-like, terete, 1–11 cm long, erect, usually shorter than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals ovate to lanceolate, 1.8–3 mm long, shorter than mature capsule by 1 mm, the tips broadly acute to obtuse; inner tepals obtuse, wider than outer tepals; outer tepals broadly acute, sometimes awn-tipped, green to red, fading to straw or dark brown; stamens 6; filaments 0.5–1.0 mm long; anthers 0.4–0.6 mm long, shorter than to subequal to filament length. CAPSULES ellipsoid to ovoid, trigonous, imperfectly 3-locular, 2.8–4 mm long, 0.8–1.2 mm wide, 0.5–1.0 mm longer than the tepals, coppery, chestnut to dark brown, the apices acute, the mucro 0.2–0.4 mm long. SEEDS plumply obovoid, 0.4 mm long, 0.2 mm wide, yellow to brown, reticulate with raised veins, apiculate, not tailed, 2n = 80.—Wetlands, moist soil in lake and stream margins, in ditches, roadsides, meadows, and ponds: Apache, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Navajo, Santa Cruz, and Yavapai cos.; 350–2700 m (1200–8800 ft.); May–Sept; in the ne and nw U.S., with scattered disjunct populations in the Intermountain West and Great Plains; extreme s Can.; Eurasia; AZ plants are at the southern end of the range for this species. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus articulatus is widespread in AZ, and one of the more common lower to mid-elevation rushes (it does reach higher elevations in the Chuska & Carrizo mountains in ne AZ). It can be small, with fibrous roots, and appear to be annual. It can usually be identified by its small heads on widely divaricate branches and exserted capsules. It has been confused with *Juncus acuminatus* (see discussion under *J. acuminatus*). A close relative, *Juncus alpinoarticulatus* Chaix [*J. alpinus* Villars], approaches AZ in s UT, and should be looked for in the northern part of the state. *Juncus alpinoarticulatus* inflorescence branches are upright, compared to the spreading branches of *J. articulatus*, and its inner tepals are shorter and obtuse to round at the tip, compared to the acute inner tepals of *J. articulatus*.

Juncus balticus Willdenow (referring to the Baltic Sea) Baltic rush.—Plants perennial, with culms single or occasionally a few clumped from long, stout rhizomes; rhizomes dark-colored, (0.7)2–4 mm thick, the internodes between culms from 0–3+ cm long. CULMS terete to slightly compressed, wiry, rarely loosely helical, 20–100 cm tall, 0.6–4 mm thick near the base; cauline leaf producing nodes lacking. BLADELESS SHEATHS 3–6, straw to rich brown, often shiny and longitudinally wrinkled, the upper ones sometimes mucronate, sometimes with a delicate awn up to 3 mm long (often broken off in herbarium specimens). LEAVES all basal; basal portion of the sheaths usually deep, rich brown, sometimes straw; auricles lacking; blades lacking. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 2–10 cm long, from compact with as few as 3 flowers, to loose with many branches and over 100 flowers; bracts at base of branches similar to bracteoles, but longer and narrower, often with awns 1+ mm long; proximal bract cylindric, resembling a continuation of the culm, 2.5–30+ cm long. FLOWERS borne singly or several close together; bracteoles 2, at the base of each flower, often a third below these that is longer and narrower, broadly ovate, 1.2–2.5 mm long, membranous, acute, mucronate; tepals lanceolate, [2.5–]3.5–5[–6] mm long, equal in length, straw or chestnut brown, the midstripe green, the margins brown or hyaline, the tips acuminate; stamens 6; filaments 0.2–0.8 mm long; anthers 1.2–2.2 mm long, 3–5 times longer than the filaments. CAPSULES ovoid, 3-locular, (3–)4–6 mm long, 1.4–1.8 mm wide, longer (rarely shorter) than the tepals, straw to brown, smooth and shiny, the apices broadly rounded or acute, the mucro 0.2-0.6 mm long. SEEDS ovoid, 0.5–0.8 mm long, 0.3–0.4 mm wide, greyish to dark amber, fine horizontally reticulations more obvious that the longitudinal reticulations, not tailed, the ends minutely apiculate. 2n = unknown. —6 subsp., 2 in the U.S.; AZ plants belong to subsp. ***ater*** (Rydb.) Snogerup [*J. balticus* Willdenow var. *montanus* Engelmann, *J. arcticus* Willdenow var. *montanus* (Engelmann) Welsh Anders.], which has straighter inflorescence branches and longer bracteoles than subsp. *littoralis* (Engelm.) Snogerup of e U.S.—Wet meadows, stream banks and lakeshores, marshy areas, ditches, and open wetlands, often in alkaline areas, tolerating soils that dry out seasonally; widespread in AZ at mid to higher elevations: all AZ cos except for Graham (expected there), La Paz, Maricopa, and Yuma; 300–2800 m (1000–9400 ft.); Apr–Sept; from AK and the Pacific NW to the Rocky Mountain states, s through the entire West to Mex.; Can., C. & S. Amer.; Eur.; Asia. SUBGENUS *Poiophylli*; SECTION *Juncotypus*.

Juncus balticus subsp. *ater* is one of the most common and widespread rushes in AZ, usually forming extensive colonies. It thrives on the margins of wetlands, or in seasonally wet areas that are prone to more drying out than many other species of rush will tolerate. Many floras have followed Hylander (1953, as cited in Snogerup, Zika, and Kirschner 2002) and

subsumed *J. balticus* into a broadly circumscribed *J. arcticus* Willd., but Snogerup, Zika, and Kirschner (2002) state that despite areas of sympatric overlap, the two taxa maintain several distinctive characters without any sign of intermediates, and so they reinstated *J. balticus* at the species level. More recently, Zika in Jepson II (2012) has followed the same reasoning to reinstate *J. mexicanus* Willdenow at the species level. These two taxa are both present and sympatric in AZ. In addition, lacking leaf blades, *J. balticus* is generally more robust (though depauperate specimens exist from higher elevations and marginal habitats) and less frequently exhibits the helical culms more commonly found in *J. mexicanus*. We have noticed in a few AZ specimens that there are seed texture differences between *J. balticus* and *J. mexicanus*, something not mentioned in previous treatments. In our plants, *J. balticus* seeds have the longitudinal striae closer spaced than the transverse striae, while the opposite seems to hold true for those of *J. mexicanus*. This character should be investigated throughout the range of the two species.

Juncus brevicaudatus (Engelmann) Fernald (from the Latin brevis, meaning short, and caudate, meaning ending with a tail-like appendage, for the short-tailed seeds) Narrow-panicled rush.—Plants perennial, cespitose. CULMS terete, 14–70 cm tall, 1–3 mm thick, smooth; cauline leaf producing nodes present. BLADELESS SHEATHS 0–4, 1–3 basal, 1–2 cauline, light brown to pink, the tips broadly rounded, often asymmetrical, usually with blade-like awns up to 14 mm long. LEAVES both basal and cauline, basal 3, cauline 1-2; sheaths green to red; auricles 0.4–1[–3] mm long, rounded to truncate, scarious; blades terete, hollow, 1–30 cm long, [0.5–]1–2[–2.5] mm wide, perfectly septate with crosswalls visible externally, pale to bright green, the distal portions long acuminate, the tips blunt (rarely acute), indurate. INFLORESCENCE terminal, [1–]2–15 cm long, composed of 2–35 heads on stiffly ascending branches; heads ellipsoid to narrowly obconic, 2–8 flowered, 2–5[–9] mm thick, subtended by a pair of ovate, scarious bracts, sometimes with other similar bracts mixed in the head; proximal inflorescence bract leaf-like, terete, 1.5–10 cm long, erect, shorter than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals 2.3–3.2 mm long, lanceolate, shiny green, the margins hyaline, fading to brown and red, the tips acuminate (rarely obtuse), red; inner tepals slightly longer than the outer; stamens 3(6); filaments 1 mm long; anthers 0.3–0.5 mm long, 1/3–1/2 as long as the filaments. CAPSULES narrowly ellipsoid to prismatic, imperfectly 3-locular, [3.2–]4–4.2[–4.8] mm long, 1.0 mm wide, exserted 0.5-1.4 beyond the tepals, shiny, dark chestnut brown, the apices rounded to acute, the mucro about 0.2 mm long. SEEDS fusiform, the body 0.5-0.6 mm long, 0.2 mm wide, longitudinally ridged, with faint reticulations, tailed at each end, the tails 0.1–0.3 mm long. 2n = 80. [*J. canadensis* J. Gay var. *brevicaudatus* Engelmann, *J. tweedyi* Rydberg].—In acidic or peaty moist sites, shallow seasonal ponds and wetlands: Coconino and Navajo cos. along the Mogollon Rim; 2050–2400 m (6800–7900 ft.); Jul–Aug; ne U.S., with scattered disjunct populations throughout the w U.S.; se Can. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus brevicaudatus is both rare and local along the Mogollon Rim in AZ. It might be confused with *J. articulatus* due to its strongly exserted capsules in small obconic heads, but *J. brevicaudatus* is a more strictly upright plant, with inflorescence branches that are ascending, rather than more widely spreading. The tailed seeds will separate *J. brevicaudatus* from all other taxa in Section *Ozophyllum* in AZ.

Juncus bryoides F.J. Hermann (from the greek bryos, for moss) Mosslike dwarf rush.—Plants diminutive, annual, cespitose with fibrous roots. CULMS one to many, terete, 3–15 [–20] mm tall, 0.1–0.2 mm wide, not branching, pale green to pale red; cauline leaf producing nodes lacking. BLADELESS SHEATHS 0. LEAVES all basal, lower portions often with hyaline margins; sheaths and auricles lacking; blades flat with face toward culm to involute, up to 6[–9] mm long, less than 1 mm wide. INFLORESCENCE composed of a solitary terminal flower; inflorescence bract lacking. FLOWERS with [1–]2 subtending bracts, the bracts ovate, membranous, inconspicuous, [0.3–]0.6—1.0 mm long; tepals lanceolate to oblong, [1.2–]2.2–2.6[–2.8] mm long, 0.4–0.6 mm wide, about equal in length, the midrib narrow, the margins red and broad hyaline (suffused with reddish brown), the tips acute to acuminate, turning inward to enwrap shorter capsules at maturity; stamens 3; filaments 0.3–0.6 mm long; anthers 0.15–0.3 mm long. CAPSULES ovoid to ellipsoid, 3-locular, 1–1.9 mm long, 0.5–1 mm wide, shorter than the tepals, reddish, slightly papillate, shiny, the apices obtuse. SEEDS not tailed, 0.3–0.5 mm long, 0.2 mm wide, pale reddish brown, ovoid to globose. 2n = ca. 38.—Moist sandy soil in washes, swales in meadows, and seeping areas on sandstone bedrock: Mohave and Yavapai cos.; 1615-1675 m (5300-5500 ft.); May; CA, CO, ID, NV, OR, UT; Mex. SUBGENUS *Juncus*. SECTION *Caespitosi.*

Juncus bryoides is the smallest rush in AZ, and is distinguished from the other annual, *J. bufonius,* by its stems with a single terminal flower, shorter leaves, and shorter stature. It is known from only three collections in AZ, two nw of Prescott and the other near Colorado City at the UT border, but is easily overlooked and may be more common than indicated by these few records.

Juncus bufonius Linnaeus (from the Latin bufo, for toad) Toad Rush.—Plants annual, cespitose with fibrous roots, single to many stemmed, the fresh growth erect, spreading with maturity. CULMS terete, 2–30 cm tall, sometimes branching; nodes sometimes present. BLADELESS SHEATHS 0(–2). LEAVES both basal and cauline, basal 1-4, cauline 0-1, long-sheathing, the sheath margins membranous; auricles truncate to rounded or lacking; blades flat with face toward culm to involute, 3–13 cm long, 0.3–1.1 mm wide. INFLORESCENCE terminal, loose and diffuse or less often compact, usually at least 1/2 height or more of the plant, composed of several to many individual flowers (occasionally 2-3 clustered); proximal bract leaf-like, filiform, long sheathing, shorter than inflorescence, rarely longer. FLOWERS borne singly, usually widely spaced along the inflorescence axis; bracteoles 2, 1-2.5 mm long; tepals lanceolate, 2.4–7(–8.5) mm long, greenish, hyaline margined, the tips acuminate or shortly awn-tipped; inner tepals equal to slightly shorter, the tips less pointed than the tips of the outer tepals; stamens usually 6, sometimes 3; filaments (0.7–)1–1.8 mm long; anthers 0.3–0.5(–0.8) mm long, usually shorter than but sometimes equaling the filaments. CAPSULES narrowly ellipsoid to ellipsoid, imperfectly 3-locular, (2.7) 3.2–4.2 mm long, 1–1.5 mm wide, usually shorter than the outer tepals, greenish to tan to reddish brown, smooth and shiny, the apices obtuse or with mucro 0.05 to 0.2 mm long. SEEDS widely ellipsoid to nearly orbicular, 0.3-0.5 mm long, yellowish to golden brown, smooth to reticulate or wrinkled, not tailed. 2n = 27–37, 58–81, 108–115. [*J. sphaerocarpus* Nees of AZ reports, *J. bufonius* var. *occidentalis* F.J. Hermann].—Receding pond and lake margins, streambanks, moist soil in washes, ditches, and roadsides, usually in open, damp, sunny sites: all AZ cos; 0–2700 m (200–8800 ft.); Mar–Sept; throughout N. Amer. except north of the taiga in Can. and AK, nearly worldwide. SUBGENUS *Poiophylli*; SECTION *Tenageia*.

Juncus bufonius is the most common annual rush in AZ. It is distinguished from *J. bryoides* by its multi-flowered inflorescences, longer leaves, and taller stature. *Juncus bufonius* may be confused with depauperate plants of its perennial relatives in Subgenus *Poiophylli* (*J. confusus, J. dudleyi, J. interior, J. tenuis*), but can usually be separated by its proportionally longer inflorescences (at least half the height of the plant) and branching culms. Many segregate taxa have been proposed, based on tepal size and shape, but insufficient evidence exists upon which to reliably base these divisions.

Juncus confusus Coville (confusing; prior to naming, the plants had been confused with *J. tenuis* var. *congestus*, now known as *J. occidentalis,* a Pacific Coast species also with congested inflorescences and dark striped tepals) Colorado rush.—Plants perennial, cespitose from short, densely branching rhizomes. CULMS terete, 30–50 cm tall, 0.5–1.2 mm thick; cauline leaf producing nodes lacking. BLADELESS SHEATHS 1–3. LEAVES all basal, 2–4 per culm; sheaths green, glabrous, margins scarious; auricles rounded, 0.2–0.7(–1.5) mm long, scarious to membranous; blades flat with face toward culm to involute, 5–15 cm long, 0.4–1.3 mm wide. INFLORESCENCE terminal, 1–2.5 cm long, compact and congested, composed of 3–25 flowers, with 1–3(–5) primary branches; proximal bract leaf-like, 1–13 cm long, usually exceeding inflorescence. FLOWERS borne singly; bracteoles 2, ovate, 1.5–2.3 mm long, membranous; tepals lanceolate or elliptic-lanceolate, 3.0–4.5 mm long, the tips acute, the midvein brown, bordered with dark green to blackish stripes, the margins membranous; inner tepals approximately equal to slightly shorter than the outer; stamens 6; filaments 0.6–1.4 mm long; anthers 0.3–0.5 mm long. CAPSULES subglobose to broadly obovoid, 3-locular, 2.5–3.5 mm long, 1.3–1.8 mm wide, shorter than the tepals, tan, the apices strongly retuse, the top of the valve partitions forming sharp ridges, mucro lacking. SEEDS ellipsoid to ovoid, 0.4–0.5 mm long, 0.2 mm wide, yellowish to golden brown, reticulate veined, not tailed. 2n = ca. 80.—Moist grassy meadows and streambanks at high elevations: Apache and Coconino cos.; 2350–2800 m (7800–9100 ft.); Jun–Sept; primarily a plant of the Intermountain West, CA, CO, ID, MT, NV, OR, SD, UT, WA, WY; sw Can. In AZ, *J. confusus* is found only on the Kaibab Plateau, around the San Francisco Peaks, and in the Chuska Mts. SUBGENUS *Poiophylli*; SECTION *Steirochloa*.

Juncus confusus resembles the far more common *J. interior* and *J. dudleyi*, but is a slightly smaller plant with narrower culms, and always has congested inflorescences compared to its other close relatives (although the inflorescences of immature specimens of these relatives can appear congested before they expand in maturity). The auricles of *J. confusus* are membranous like those of *J. tenuis*, which caused misidentifications when the retuse capsules and dark brown striped tepals were not considered. However, *J. confusus* auricles are usually shorter and rarely as long as those of *J. tenuis*.

Juncus cooperi Engelmann (after James Graham Cooper, 1830–1902, American surgeon and naturalist, who made botanical collections from San Diego to Fort Mojave in Arizona in 1861) Cooper's rush.—Plants perennial, cespitose, robust, densely tufted; rhizomes inconspicuous if present. CULMS terete, 4–10 dm tall, 1–3 mm thick, strongly ribbed with 6–11 ribs per side; cauline leaf producing nodes lacking. BLADELESS SHEATHS 1–4, often pungent, the distal bladeless sheath with pseudo-blade. LEAVES all basal, 1–2 per culm; sheaths shiny brown, longitudinally wrinkled; auricles lacking; blades terete, 2–40 cm long, 0.7–2 mm wide, without crosswalls, strongly ribbed with 10–11 ribs per side, the tips pungent. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a

continuation of the culm, 3–22 cm long, compact to open, composed of 3–30+ glomerules on unequal, ascending to spreading branches; glomerules with (1–)2–5 flowers each; each branch, glomerule, and flower subtended by one hyaline bract; proximal inflorescence bract distally terete or somewhat compressed, pungent, shorter to longer than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals ovate-lanceolate, 4–5 mm long, straw-colored to pale green, the margins wide, hyaline, the tips acuminate to setaceous; inner tepals acute; outer tepals acute to apiculate; stamens 6; filaments about 1 mm long; anthers 1.2–2.6 mm long. CAPSULES ellipsoid, 3-locular, 3.5–4.5 mm long, 1.6–2 mm wide, as long as to 1 mm longer than the perianth, tan to light brown, shiny, slightly textured, the apices acute, the mucro 0.2–0.4 mm long. SEEDS obovoid, the body 0.6–0.7 mm long, 0.4–0.5 mm wide, dark amber, tailed, the tails flattened, hyaline, 0.1–0.4 mm long.—Saline flats, alkaline seeps and springs: Pima Co.; 300-350 m (1000-1100 ft); Apr–Aug; CA, NV; Mex. SUBGENUS *Juncus*; SECTION *Juncus*.

Juncus cooperi is presently known in AZ only from Quitobaquito Spring in Organ Pipe Cactus National Monument. It should be looked for in western AZ, as it has been collected in the Colorado River corridor in NV, CA, and Mex. See discussion following *J. acutus*.

Juncus dichotomous Elliott (for the dichotomous panicle) Forked rush.—Plants perennial, cespitose from short, densely branching rhizomes. CULMS terete, to 100 cm tall, 1.5–2.5 mm thick; cauline leaf producing nodes lacking. BLADELESS SHEATHS inconspicuous. LEAVES all basal, 1–2(–3) per culm; sheaths loose, the margins green; auricles rounded, 0.2–0.5(–0.6) mm long, scarious to leathery, often not symmetric; blades [1–]3, 10–25(–40) cm long, (0.5–)0.7–1(–1.2) mm wide, channeled to involute. INFLORESCENCE terminal, 2–8 cm long, compact and few-flowered to more or less open, composed of [10–]20–30[–100] flowers, with 1–2 primary branches; branches subtended by bracts similar to bracteoles, often awned, the awns up to 15 mm; proximal bract leaf-like, 8–20 cm long, often 2X as long as the inflorescence. FLOWERS borne singly; bracteoles 2, broadly ovate, 1.8–3.0 mm long, membranous, sometimes awn-tipped with awns up to 0.4 mm long; tepals lanceolate, [3–]4.5–5.2[–5.5] mm long, the midstripe broad, greenish, with reddish borders and tips, the margins membranous, the tips acute to acuminate; inner tepals shorter to equal to the outer (rarely longer); stamens 6; filaments equal or slightly longer than the anthers; anthers [0.4–]1–1.2 mm long. CAPSULES ellipsoid to subglobose, imperfectly 3-locular, the locules partitioned at the base only, [2.5–]3.2–4.2[–4.5] mm long, [1.6–]2.4–2.6 mm wide, shorter than the tepals, gold to brown, shiny, the apices blunt to slightly retuse, usually with mucro 0.2(–0.4) mm long. SEEDS ellipsoid to slightly lunate, 0.4 mm long, 0.2 mm wide, gold to brown, reticulate, not tailed. 2n = ca 80. [*J. dichotomus* E. Mey., *J. dichotomus* var. *platyphyllus* Wiegand].—Moist areas along stream banks, ditches, and around springs, and somewhat drier open areas, in well-drained but seasonally wet sand; in AZ known only from Garden Canyon in the Huachuca Mts.: Cochise Co.; 1800–1900 m (6000–6200 ft.); Apr–Sept; throughout the e and s part of the U.S. to CA, Mex. to S. Amer. SUBGENUS *Poiophylli*; SECTION *Steirochloa*.

Our description of *Juncus dichotomus* differs from the coastal plants of se U.S. described in Brooks & Clemants (2002b), which have shorter culms and anthers. Our desription is based on the few collections that we have of unique plants from the Huachuca Mts. in s AZ. According to Zika (personal communications), these plants more closely resemble the phase of *J. dichotomus* found in s Mex. and C. Amer., tending to be larger and coarser than the se

U.S. plants. They could easily be mistaken for robust specimens of either *J. interior* or *J. dudleyi*, with auricles intermediate between these two species. The tepals are long, more like those of *J. dudleyi*. More work is needed here. We have not been able to examine the Mexican plants to which Zika refers; perhaps the AZ and more southern plants are worthy of taxonomic distinction.

Juncus drummondii E. Meyer (for Thomas Drummond, 1793-1835, Scottish botanist, who explored the Canadian Rocky Mountains in 1825) Drummond's rush.—Plants perennial, densely cespitose with numerous tufted culms. CULMS terete to slightly flattened, wiry, 8–40 cm tall, 0.8–1.0 mm thick near the base; cauline leaf producing nodes lacking. BLADELESS SHEATHS 3–4, light to dark brown, the upper often with mucronate tip, the tips sometimes prolonged into an awn, 0.4–3+ mm long (often broken off in herbarium specimens). LEAVES all basal, terete; basal portion of the sheaths light brown; auricles lacking; blades absent, or if present, awn-like, up to 1 cm long. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 5–15 mm long, composed of (1–)2–3(–5) clustered, ascending flowers; proximal bract cylindric, exceeding the inflorescence by as much as 1.3 cm. FLOWERS borne singly or several close together; bracteoles 2, broadly ovate, membranous to brown; lower bracteoles acute, 2–3.5 mm long; upper bracteoles broadly lanceolate, 4–5.5 mm long, with awn about 1 mm long; tepals lanceolate to widely lanceolate, 4–7[–8] mm long, chestnut brown with a dull green mid-stripe, the tips acuminate; outer tepals slightly longer than the inner tepals; stamens 6; filaments 0.7–1.0 mm long; anthers 0.9–1.6 mm long, longer than the filaments. CAPSULES narrowly ellipsoid, 3-locular, 4.5–7 mm long, 1.5–2.5 mm wide, slightly shorter to slightly longer than the tepals, light brown at base, the apices darker brown, smooth and shiny, blunt to retuse, often with mucro to 0.2 mm. SEEDS narrowly ellipsoid, body 0.5–0.6 mm long, 0.2–0.3 mm wide, amber, reticulate veined, tailed, each tail 0.5-1 mm long. 2n = unknown.—Wet and dry meadows, stream banks, talus slopes, and ridges, in alpine habitats; in AZ known only from the San Francisco Peaks: Coconino Co; 3450-3500 m (11,400-11,500 ft.); Jul–Aug; from AK and the Pacific NW to the Sierra Nevada in CA and in NM at the s end of the Rocky Mts. SUBGENUS *Poiophylli*; SECTION *Juncotypus*.

Juncus drummondii is found in the uppermost alpine bowl of the inner basin of the San Francisco Peaks. This population is the southernmost occurrence of this species, and is far disjunct from its nearest location in the San Juan Mts. of sw CO. It is unique in its clumping habit, few-flowered, lateral (seeming) inflorescences that occur high on the culm with a short bract extension above, and its generally awn-like blades.

Juncus dudleyi Wiegand (for William Russell Dudley, 1849–1911, Chairman of the Stanford Botany Department 1892-1911) Dudley's rush.—Plants perennial, cespitose from short, densely branching rhizomes. CULMS terete, 20–90 cm tall, 0.5–2.4 mm thick; cauline leaf producing nodes lacking. BLADELESS SHEATHS 1–3. LEAVES all basal, 2–3 per culm; sheaths glabrous, green, loose, the margins opaque, the bases sometimes pinkish red; auricles rounded, 0.2–0.4 mm long, yellowish, leathery to cartilaginous throughout with thick rim; blades flat with face toward culm to involute, 5–30 cm long, 0.5–1 mm wide. INFLORESCENCE terminal, 1–6(–9) cm long, compact and few-flowered to more or less open, composed of up to 80 flowers, with 1–5 primary branches; branches subtended by bracts similar to bracteoles, but more often awned up to 0.4 mm; proximal bract leaf-like, 3–15(–27)

cm long, usually exceeding inflorescence. FLOWERS borne singly; bracteoles 2, ovate, 1.2–2.0 mm long, membranous, rarely awned to 0.2 mm; tepals lanceolate, 4–6 mm long, the midvein broad, greenish, bordered with stramineous-brown, the margins broad, membranous, the tips acuminate, sometimes reddish; inner tepals shorter than the outer; stamens 6; filaments 0.8–1.2 mm long; anthers 0.6–1 mm long. CAPSULES ellipsoid, imperfectly 3-locular, the locules partitioned at the base only, 2.2–4.2 mm long, 1.2–1.9 mm wide, shorter than the tepals, green, fading to bronze, the apices obtuse or truncate, usually with mucro up to 0.4 mm long. SEEDS ellipsoid to lunate, 0.4–0.65 mm long, 0.2–0.3 mm wide, tan to amber, alveolate-reticulate, not tailed. 2n = ca. 84. [*J. tenuis* Willdenow var. *dudleyi* (Weigand) F. J. Hermann].—Moist areas along stream banks, ditches, and around springs: Apache, Cochise, Coconino, Gila, Greenlee, Maricopa, Mohave, Navajo, Pima, Santa Cruz, and Yavapai cos; 1000–2550 m (3200–8400 ft.); May–Sept; widely distributed in the U.S., absent only from CA, NV, and the se states; s Can., Mex., introduced in C. & S. Amer. SUBGENUS *Poiophylli*; SECTION *Steirochloa*.

Juncus dudleyi is one of several look-a-like rushes in Subgenus *Poiophylli*. It would most likely be confused with specimens of *J. interior* whose auricles are inrolled on the margins, making them appear more like the thick, opaque auricles of *J. dudleyi*. In these cases, the longer tepals of *J. dudleyi* and the more frequent pinkish bases of *J. interior* can help with a determination. See also discussions under *J. confusus, J. dichotomus, J. interior* and *J. tenuis*.

Juncus effusus L. (Latin for poured-out, or extensive, vast, broad, probably for the large number of culms, but perhaps for the large number of flowers) Soft rush, Common rush.—Plants perennial, densely cespitose with numerous tufted culms. CULMS terete, stiff, 30–125(–150) cm tall, [1.2–]1.6–3.5 mm thick near the base, exceeding the inflorescence by 1–13 cm, the fresh culms shiny, smooth, the dried culms striate with 6–18 ridges per side at 10x); cauline leaf producing nodes lacking. BLADELESS SHEATHS 2–4, the upper 4-16 cm long, the bases reddish brown, often shiny, scarious wing-margined, often red-spotted, Upper sheaths with asymmetrical scarious wings on the symmetrical shoulders either side of the awn (see image guide), (scarious wings often damaged or missing on older specimens), sheaths lighter brown with only slight darkening, the base rusty brown to pinkish or salmon colored (our subspecies), dull green to pale brown when dry, mucronate, sometimes prolonged into an awn, 2–4 mm long (often broken off in herbarium specimens). LEAVES all basal; blades lacking. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, (2–)4–8(–11) cm long, [1.2–]2–8 cm wide, composed of 30–250+ flowers on lax, paniculate branches; proximal bract cylindric, exceeding the inflorescence by 5-36 cm. FLOWERS borne singly or several close together; bracteoles 2, inconspicuous, broadly ovate, 0.5–1.4 mm long, hyaline to green or brown, acute, sometimes with an awn up to 0.6 mm long; tepals lanceolate,1.8–3(–3.6) mm long, chestnut brown with a dull green mid-stripe, the tips acuminate; inner tepals subequal to slightly shorter than the outer tepals, the tips acute, apiculate; stamens 3; filaments 0.4–0.6 mm long; anthers 0.6–0.8 mm long, often about equal to the filaments. CAPSULES trigonous-obovoid, 3-locular, 1.4–1.8 mm long, about 1 mm wide, subequal to shorter than the tepals, olive-brown, shiny, smooth with longitudinal striations, the apices slightly retuse, mucro lacking or with mucro to 0.2 mm long. SEEDS obliquely ovoid, 0.4–0.5 mm long, 0.3 mm wide, light reddish yellow, reticulate, without tails, apiculate. 2n = 40, 42, 80. —5 subsp., 3 in the U.S.; AZ plants belong to subsp. ***austrocalifornicus*** Lint ex P.F. Zika in AZ, which differs from subsp. *pacificus* (Fernald &

Wiegand) Lint of the Pacific Coast in having thinner, lighter colored upper bladeless sheath margins, and from subsp. *solutus* (Fernald & Wiegand) Hamet-Ahti in having the upper bladeless sheath margins asymmetrical rather than symmetrical.—Wet meadows, forest swales, stream banks, canyon bottoms, in Madrean Oak Woodland to Mixed Conifer Forests: Cochise, Coconino, Graham, Pima, and Santa Cruz cos; 800–2450 m (2700–8000 ft.); May–Aug; from s CA to n Baja C.; disjunct in s AZ. In AZ known from the Santa Catalina, Huachuca, Patagonia, Pinaleno, Rincon, and Santa Rita mountains, with one outlier collected on the Mogollon Rim. SUBGENUS: *Poiophylli*; SECTION *Juncotypus*

Zika (2003) named *Juncus effusus* subsp. *austrocalifornicus* to differentiate the large clumping plants of s CA & AZ from their relatives further north on the Pacific Coast. In AZ, *J. effusus* subsp. *austrocalifornicus* has been confused with *J. laccatus*, also recently described. *J. laccatus* is a narrower-stemmed species with dark glossy bladeless sheaths native to the Pacific Coast from n CA to BC in Can., with a disjunct population in c AZ. Both are large plants, but *J. effusus* gets taller, tends to have thicker culms (1.6–3.5 mm wide at the base), and the upper bladeless sheaths are paler, with thin edges and an asymmetrical tip (which can be eroded later in the season and on old culms), compared to *J. laccatus*, whose culms are 0.6–2.6 mm wide, with symmetrical, dark, shiny tipped bladeless sheaths. Our present understanding is that the ranges of the two do not significantly overlap in AZ, with *J. laccatus* found on the Mogollon Rim and in the c AZ mountains, and *J. effusus* found in the southern Sky Island ranges with one outlier on the Mogollon Rim. A third similar species in this group, *J. exiguus*, is known in AZ from just four locations in the Bradshaw and Mazatzal mtns. *J. exiguus* has narrower culms (0.8-1.6 mm wide) than *J. effusus* (1.6-3.5 mm wide) and differs in that its upper bladeless sheath tips are symmetrical like those of *J. laccatus*, but they are thin tipped and paler green throughout, except for a little darkening at the tip.

Juncus exiguus (Fernald et Wiegand) H. L. Lint ex Snogerup & P. L. Zika (Latin word meaning small, short, poor, or scanty, for the smaller stature of this plant compared to *J. effusus*, of which it was originally named a variety) Klamath rush, Weak rush.—Plants perennial, densely cespitose with numerous tufted culms; rhizomes short, densely branching, 0.6–2.2 mm thick, with minimal or no internodes between culms. CULMS terete, wiry, (25–) 40–90 cm tall, 0.8–1.4(–1.6) mm thick near the base, the tips usually exceeding the inflorescence by 4.3–21 cm, the fresh culms shiny, green, smooth, the dried culms blue-green, striate with 15–20 ridges per side at 10x); cauline leaf producing nodes lacking. BLADELESS SHEATHS 3–4, the upper (3–)5–11(–14) cm long, the bases pale brown to castaneous, the distal portions green, pale brown to castaneous, dull, thin, membranous, the tips symmetric, rounded to obtuse, mucronate, slightly thickened, dark, sometimes prolonged into an awn, 0.5–3.5 mm long (often broken off in herbarium specimens), the veins prominent and converging gradually to the tips. LEAVES all basal; basal portion of the sheaths light brown; auricles lacking; blades usually lacking. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 1–7 cm long, 0.6–4 cm wide, composed of 30–100+ flowers on lax paniculate branches; proximal bract cylindric, exceeding the inflorescence by 6-11 cm. FLOWERS borne singly or several close together; bracteoles 2, membranous to brown; lower bracteole broadly ovate, 1.3–1.5 mm long, acute; upper bracteole broadly lanceolate, 1.3–1.4 mm long, with awn about 1 mm long; tepals lanceolate, 1.5–3 mm long, the midstripe dull green bordered by brown bands, the margins hyaline, the tips acuminate; outer tepals longer than the inner tepals; stamens 3; filaments 0.8 mm long; anthers

0.7–0.8 mm long, about equal to the filaments. CAPSULES trigonous-obovoid, 3-locular, 2.2–3 mm long, 1.0–1.2 mm wide, shorter than to equaling the tepals, pale olive brown (rarely darker), smooth, shiny, longitudinally striate, the apices broadly rounded, with or without mucro. SEEDS obliquely ovoid, 0.4–0.6 mm long, 0.2 mm wide, light brown, reticulate, without tails, apiculate. 2n = 40, 42, 80. [*J. effusus* L. var. *exiguus* Fernald & Wiegand].—Wet meadows, springs, forest swales, stream banks, pond and lakeshores: Gila and Yavapai cos; 1650–2100 m (5500—6900 ft.); May–Aug; from c OR to the Sierra Nevada in CA; disjunct in c AZ. In AZ, known from the Bradshaw and Mazatzal mountains. SUBGENUS: *Poiophylli*; SECTION *Juncotypus*

Juncus exiguus is most similar to *J. laccatus*, with the main difference being the upper bladeless sheath characters given in the key: darker, thicker, and shiny in the case of *J. laccatus*. *J. exiguus* could also be confused with *J. effusus* subsp. *austrocalifornicus*, which is a more robust plant, but with somewhat similar thin pale brown upper bladeless sheaths. However, the bladeless sheaths of *J. effusus* subsp. *austrocalifornicus* have asymmetrically expanded margins on either side of the awn when fresh, while those of *J. exiguus* are symmetrical and not expanded.

Juncus interior Wiegand (for its range in the central US) Interior rush.—Plants perennial, cespitose from short, densely branching rhizomes. CULMS terete, 20–60 cm tall, 0.5–3.2 mm thick; cauline leaf producing nodes lacking. BLADELESS SHEATHS 1–3. LEAVES all basal, 1–2(–3) per culm; sheaths loose, the bases almost always pinkish; auricles rounded to acute, 0.2–0.4(–0.6) mm long, whitish, thin edged with thicker base, margins scarious; blades flat with face toward culm to involute, 5–15(–30) cm long, 0.3–1.1 mm wide. INFLORESCENCE terminal, 1–7 cm long, compact and few-flowered to more or less open, composed of (5–)10–30(–50) flowers, with 1–3(–5) primary branches; branches subtended by bracts similar to bracteoles, these bracts often awned up to 2 mm; proximal bract leaf-like, 1–15 cm long, longer than the inflorescence. FLOWERS borne singly; bracteoles 2, broadly ovate, 1.2–2.0 mm long, membranous, sometimes awn-tipped (often breaking off in mature plants), the awns up to 1.2 mm long; tepals lanceolate, 3.0–3.8(–4.4) mm long, the midstripe broad, greenish, bordered with stramineous-brown, the margins broad, membranous, the tips acute to acuminate, often reddish; inner tepals approximately equal to 0.6 mm shorter than the outer (rarely longer); stamens 6; filaments 1.0 mm long; anthers 0.4–0.6 mm long. CAPSULES ellipsoid to subglobose, imperfectly 3-locular, the locules partitioned at the base only, 2.4–4.0[–4.7] mm long, 1.4–1.7 mm wide, shorter than the tepals, tan or darker, the apices obtuse or truncate to slightly retuse, top of the valve partitions not sharp-ridged, usually with mucro 0.2(–0.4) mm long. SEEDS ellipsoid to lunate, 0.3–0.6 mm long, 0.15–0.25 mm wide, tan to amber, reticulate, not tailed. 2n = 80. [*J. arizonicus* Wiegand, *J. interior* var. *arizonicus* (Weigand) F.J. Hermann, *J. interior* var. *neomexicanus* (Weigand) F.J. Hermann, *J. neomexicanus* Wiegand].—Moist areas along stream banks, ditches, and around springs, and somewhat drier upland areas: all AZ cos except in the desert southwest (missing from La Paz and Yuma cos.); 500–2900 m (1600–9500 ft.); Apr–Sept; throughout the w and c part of the U.S., absent from NV, OR, WA, and the Atlantic states; s Can., n Mex. SUBGENUS *Poiophylli*; SECTION *Steirochloa*.

Juncus interior is the most common and widespread of several look-a-like rushes in Subgenus *Poiophylli*. It can usually be distinguished from both *J. dudleyi* (common) and *J. tenuis* (uncommon) by its auricles, which vary from thick at the base to thin and more whitish

(or clear) at the apex. *J. interior* has auricles that are close to those of *J. dichotomus*, a much rarer and localized plant in AZ, but these taxa can be distinguished by the characters in key cut 4. Smaller, immature specimens of *J. interior* with more congested inflorescences might be confused with *J. confusus*. However, the dark brown tepal striping of *J. confusus* should also be apparent in immature specimens. Also, *J. confusus* is found in Mixed Conifer Forests at high elevations in only three northern mountain ranges, while *J. interior* is widespread in many habitats with a broad elevation range. See also discussions under *J. confusus, J. dichotomus, J. dudleyi,* and *J. tenuis*.

Juncus laccatus Zika (from the Medieval Latin lacca and the Persian lak, meaning lacquer, for the shiny bladeless sheath tips) Shiny rush.—Plants perennial, densely cespitose with numerous tufted culms; rhizomes short, densely branching, 0.6–2.6 mm thick, with minimal or no internodes between culms. CULMS terete, wiry, (25–)50–100 cm tall, 0.6–2.6 mm thick near the base, the fresh culms shiny, smooth, the dried culms striate with 8–14 ridges per side at 10x); cauline leaf producing nodes lacking. BLADELESS SHEATHS 3–6, the upper 3–13[–18] cm long, dark brown to castaneous, striate, glossy, coriaceous, thick rimmed, the tips symmetric, not rolled under, mucronate, sometimes prolonged into an awn, 0.5–3.5 mm long (often broken off in herbarium specimens), the veins obscure and converging abruptly to the tips. LEAVES all basal; basal portion of the sheaths light brown; auricles lacking; blades usually lacking. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 1–6 cm long, 1–4 cm wide, composed of 20–130 flowers on lax paniculate branches; proximal bract cylindric, exceeding the inflorescence by 2–14 cm. FLOWERS borne singly or several close together, bracteoles 2, membranous to brown; lower bracteole broadly ovate, 1.3–1.5 mm long, acute; upper bracteole broadly lanceolate, 1.3–1.4 mm long, with awn about 1 mm long; tepals lanceolate, 2.2–2.9 mm long, the midstripe dull green with hyaline to brown margins, the tips acuminate; outer tepals equal to slightly longer than the inner tepals; stamens 3; filaments 0.8 mm long; anthers 0.7–0.8 mm long, about equal to the filaments. CAPSULES trigonous-obovoid, 3-locular, 2.0–2.4 mm long, 1.0-1.2 mm wide, shorter than the tepals, brown, smooth, shiny, longitudinally striate, the apices broadly rounded to slightly retuse, mucro lacking. SEEDS obliquely ovoid, 0.3–0.4[–0.6] mm long, 0.2 mm wide, amber, reticulate, without tails, apiculate. 2n = 40, 42, 80. [*J. effusus* L. var, *gracilis* Hooker].—Wet meadows, forest swales, stream banks, pond and lakeshores, in Ponderosa Pine to Mixed Conifer Forests; Coconino, Gila and Navajo cos; 1300–2350 m (4300–7700 ft.); May–Aug; from BC in Can. through OR & WA to the Sierra Nevada in CA; disjunct in c AZ. In AZ known primarily from the Mogollon Rim area, with additional populations in the Mazatzal, Pinal, and the Sierra Ancha mountains. SUBGENUS *Poiophylli*; SECTION *Juncotypus*.

Juncus laccatus is a striking plant, with densely tufted culms and shiny, dark brown bladeless sheaths that contrast with its green culms. It has been confused with *J. effusus* in the past; see discussion under *J. effusus*. It is most similar to *J. exiguus*, which differs primarily in having green bladeless sheaths that are thinner tipped and darken a little just at the top edges. In AZ, *J. exiguus* is presently known from just a few locations in the Bradshaw and Mazatzal mtns, while *J. laccatus* is common on the Mogollon Rim, with scattered populations in the Sierra Ancha, and the Mazatzal and Pinal mtns.

Juncus longistylis Torrey (long-styled) Longstyle rush.—Plants perennial, with culms single or few clumped together from long rhizomes 0.4–1.2(–1.6) mm thick, light (rarely dark) brown; internodes between culms 1–3(–6) cm. CULMS slightly flattened to terete, 20–60 (–70) cm tall, 0.5–2.2 mm wide, somewhat compressed, smooth, or rarely minutely scaberulous papillate below the inflorescence; cauline leaf producing nodes present. BLADELESS SHEATHS 0–1(–3), sheaths dull brownish, to 5 cm long. LEAVES both basal and cauline, basal 2–5, cauline 1–3; auricles obtuse to truncate, 1–2.5 mm long, scarious; blades flat with face toward culm, up to 30 cm long, 1–3 mm wide, green, not septate. INFLORESCENCE terminal, 1–6(–12) cm long, composed of 1–8(–12) heads on 1–2 short primary branches; heads obconical, composed of 3–6(–15) flowers each; proximal bract scarious, less frequently leaf-like, 1–4 cm long, narrowly attenuate to caudate, much shorter than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals lanceolate, 5–6 mm long, the midstripe pale to deep green, bordered with narrow, dark brown stripes, the margins broad, scarious, the tips acute to acuminate; inner tepals approximately equal to the outer; stamens 6; filaments 0.5–1 mm long; anthers 0.8–2 mm long. CAPSULES obovoid, varying from locular partitions adnate only at base to fully adnate to apices, 3–6.5 mm long, 2.2–2.6 mm wide, shorter (longer) than the tepals, tan to brownish black, the apices bluntly rounded to slightly retuse, the mucro up to 1.2 mm long. SEEDS ovoid, 0.4–0.6 mm long, 0.15–0.2 mm wide, brown, reticulate, not tailed. 2n = 40.—Wet mountain meadows, springs, and streambanks, at mid to higher elevations; Ponderosa Pine to Mixed Conifer Forests; throughout the state, except the desert southwest: Apache, Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Santa Cruz, and Yavapai cos.; 800–3050 m (2700–10,000ft.); Jun–Sept; throughout the w U.S. and s Can. SUBGENUS *Juncus*; SECTION *Graminifolii*.

Juncus longistylis and *J. macrophyllus* appear to intergrade in AZ, where their ranges meet. The characters that have traditionally separated these species do overlap, and there does not appear to be any one character that can be used to separate problematic specimens. *J. macrophyllus* can be significantly taller than *J. longistylis*, but many culms of *J. macrophyllus* are shorter. The culms of *J. longistylis* are usually smooth, and those of *J. macrophyllus* are usually papillate/scabrous, at least below the inflorescence. However, there are intermediate specimens where this does not hold true. *Juncus macrophyllus* is predominantly cespitose from short rhizomes, while *J. longistylis* has long rhizomes, and culms that arise singly or few together. However, this is not always obvious on specimens. *Juncus longistylis* typically has inflorescence branches that are short, while *J. macrophyllus* usually has a long lower branch, but there are specimens of *J. longistylis* with long lower branches. *Juncus longistylis* typically has fewer heads, larger flowers, and darker colored tepals and capsules than *J. macrophyllus*. However, several collections of *J. macrophyllus* exhibit few heads with larger flower clusters. *Juncus longistylis* often has fully three-locular capsules, a character we haven't seen in *J. macrophyllus*. We have used a gestalt to make determinations, a gestalt which coincides for the most part with elevation, biotic community, and range. Where the two species are sympatric, our interpretation broadens the traditional circumscription of *J. longistylis*, and includes plants with more heads than have been described in other treatments (Brooks & Clemants 2000b, Hurd et al. 1997, Kirschner 2002, Zika 2012). In these cases, we put more emphasis on the rhizomatous habit and smooth culms of these plants. More work is needed with the intermediate plants.

Juncus macrophyllus Coville (from the Greek macro & phyllo, meaning long-leaved) Longleaf rush.—Plants perennial, cespitose from short, densely branching rhizomes, with internodes between culms up to 1 cm long, dark brown. CULMS terete, 20–90 cm tall, 1.0–2.5 mm thick, finely scaberulous papillate below the inflorescence, or rarely smooth; cauline leaf producing nodes present. BLADELESS SHEATHS 0–2(–5), 0.5–3[–10] cm long, loose, pale to brown. LEAVES both basal and cauline, basal 2–5, cauline 1–4; sheaths finely scaberulous papillate; auricles obtuse to truncate, 0.8–3.0 mm long, scarious; blades flat with face toward culm, up to 45 cm long, 1–3 mm wide, pale to green, not septate. INFLORESCENCE terminal, 4–20 cm long, more or less loose, composed of 4–20[–40] heads with 2–5 primary branches; heads obconical, composed of (1–)2–14(–20) flowers each; proximal bract leaf-like, 1–3[–4] cm long, with a filiform tip, much shorter than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals, lanceolate, 3.8–5.5 mm long; outer tepals, the midstripe broad, pale green, sometimes with narrow tan marginal bands, the margins broad, scarious, the tips acute to mucronate, sometimes reddish; inner tepals approximately equal to the outer; inner tepal apices acute, mucronate, or obtuse; stamens 6; filaments [0.5–]1.0 mm long; anthers 0.9-1.7[–2.6] mm long. CAPSULES narrowly obovoid, varying from locular partitions adnate only at base to adnate nearly to apices, (2.6–)3.2–5 mm long, 1.2–1.8 mm wide, shorter than or equaling the tepals, pale brown to coppery, the apices truncate, the mucro 0.4–0.9(–1.5) mm long. SEEDS ovoid, 0.4–0.6 mm long, 0.2–0.3 mm wide, brown, regularly and evenly reticulate, not tailed. 2n = unknown. [*J. longistylis* Torreyi var. *scabratus* Hermann].—Moist areas along stream banks, in seasonally dry washes, and meadows, at lower to mid elevations in Desert Scrub or Chaparral to Ponderosa Pine communities: Coconino, La Paz, Maricopa, Mohave, Pinal, and Yavapai cos.; 450–1900 m (1500–6200 ft.); May–Aug; confined to the sw U.S., s CA, s NV, sw UT. SUBGENUS *Juncus*; SECTION *Graminifolii*.

See discussion under *Juncus longistylis*.

Juncus marginatus Rostkovius (from the Latin *marginem,* for the narrow hyaline margins of the tepals) Grassleaf rush.—Plants perennial, cespitose from short, knotty rhizomes. CULMS slightly compressed, 30–80[–130] cm tall, [0.5–]1–3 mm thick, sometimes bulbous based, smooth, but longitudinally wrinkled; cauline leaf producing nodes present. BLADELESS SHEATHS 0. LEAVES both basal and cauline, basal 2–5, cauline 1–6; sheaths to 9 cm long, sometimes finely scaberulous papillate; auricles rounded, 0.2–1[–3] mm long, scarious; blades flat with face toward culm, up to 10–20[–45] cm long, 1.5–5 mm wide, pale green, usually with a prominent abaxial midrib and two distinct abaxial veins, not septate. INFLORESCENCE terminal, 2–16 cm long, 2–7[–10] cm wide, usually diffuse and wide spreading, occasionally compact, composed of [5–]10–50[–200+] obconic heads, with 1–10 primary branches arising from each of up to 3 nodes along the inflorescence; heads 3–8 mm wide, more or less hemispherical, composed of (1–)3–9(–20) flowers each, straw-colored to dark brown; bracts below heads lanceolate, acute, scarious, shorter than to as long as the tepals; proximal bract leaf-like, 1–16 cm long, usually shorter than the mature inflorescence. FLOWERS clustered in small heads; lacking a pair of bracteoles; tepals broadly ovate-lanceolate, [1.5–]2.0–3.0[–3.2] mm long, the midstripe green, tan or brown, often striate with brown streaks, the margins broad, scarious, the tip obtuse to acute, often mucronate; inner tepals longer than the outer by up to 0.5 mm; stamens 3; filaments 0.8–1.2[–2.5] mm long; anthers [0.3–]0.4–1.2[–1.2] mm long. CAPSULES obovoid to nearly globose, 3-locular,

(1.8–) 2–2.5(–2.9) mm long, 1.2–1.4 mm wide, a little shorter or rarely subequal to the tepals, dark brown to coppery, glossy, the apices obtuse, the mucro up to 0.2 mm long. SEEDS narrowly and obliquely ellipsoid, 0.3–0.4[–0.6] mm long, 0.15–0.25 mm wide, yellow-brown, reticulate with the longitudinal veins longer than the transverse veins, not tailed. 2n = 38, 40. [*J. biflorus* Elliott, *J. marginatus* var. *biflorus* (Elliott) Alph. Wood, *J. marginatus* var. *setosus* Coville].—Moist areas along stream banks, ponds, and in seasonally dry washes, at lower to mid-elevations in Desert Scrub or Chaparral to Oak Woodland communities: Cochise, Gila, Graham, Maricopa, Pima, Pinal, and Santa Cruz cos.; 600–1850 m (2000–6000 ft.); Apr–Aug; throughout e U.S., with disjunct occurrences in AZ, CA, CO, and OR; W. Ind., C. Amer., S. Amer. SUBGENUS *Juncus*; SECTION *Graminifolii*.

Juncus marginatus can easily be separated from its two relatives in Subgenus *Graminifolii* by its smaller flowers and capsules, greater number of heads, and wider leaves. Several varieties of *J. marginatus* have been named, however most current treatments (Brooks & Clemants 2000b, Kirschner 2002) do not recognize these, citing a continuous intergradation of the characters used to separate them. More recently, Knapp & Naczi (2008) proposed that *J. marginatus* var. *biflorus* Elliott be treated as a separate species. Knapp & Naczi separate these by the following key:

1. Widest leaf blade (2.6–)3.1–4.5(–5.4) mm wide; sheath of lowest leaf (3.2–)4.3–7.8 (–9.7) cm long; tallest culm (27.2–)50.8–81.2(–100.7) cm; anthers (0.5–)0.6–1.0(–1.3) mm long, exserted; culm base (3.4–)5.8—9.6(–12.0) mm wide.....***Juncus biflorus***
1’ Widest leaf blade (1.3–)1.6–2.6(–3.5) mm wide; sheath of lowest leaf (1.7–)2.2–3.8 (–4.7) cm long; tallest culm (19.2–)26.0–44.0(–56.8) cm; anthers (0.2–)0.3–0.5(–0.7) mm long, concealed by tepals; culm base (0.4–)2.0–4.4(–6.0) mm wide…… .....***Juncus marginatus***

Most of the AZ plants would key to *Juncus biflorus*, but we have specimens that do not separate easily between the two extremes, and we do not recognize these varieties or species as distinct in AZ.

Juncus mexicanus Willdenow ex Roemer & Schultes (of Mexico) Mexican rush.—Plants perennial, with culms single or several clumped from long rhizomes; rhizomes dark-colored, 2–5 mm thick, with internodes between culms from 0–4+ cm long. CULMS variably compressed to nearly round, wiry, often loosely helical, 8–80 cm tall, 0.6–2 mm thick near the base, sometimes papillate; cauline leaf producing nodes lacking. BLADELESS SHEATHS 2–5, straw to rich brown, often shiny, often longitudinally wrinkled, the upper ones sometimes mucronate, rarely prolonged into a delicate awn up to 1.5 mm long (often broken off in herbarium specimens). LEAVES all basal; basal portion of the sheaths blackish; auricles lacking or broad, membranous, up to 1.2 mm long; ligules membranous, 0.1–0.4 mm high; blades present on at least on some culms in a patch, terete to somewhat flattened, often helical like the culms, 1–1.5 mm wide, not septate. INFLORESCENCE terminal, but appearing lateral due to the proximal bract appearing as a continuation of the culm, 0.5–8 cm long, from compact with few (3) flowers to loose with many branches and 60+ flowers; bracts at base of branches similar to bracteoles, but larger, sometimes awned up to 0.6 mm; proximal inflorescence bract terete, 4–23+ cm long. FLOWERS borne singly or several close together; bracteoles 2, with a third bract subtending these, the bracteoles broadly ovate, 1.2–2.4 mm long, membranous,

acute to mucronate; tepals lanceolate, 3.5–5(–5.5) mm long, straw, with green midstripe, the margins brown or hyaline, or chestnut brown, the tips acuminate; outer tepals approximately equal to the inner tepals; stamens 6; filaments 0.2–0.6 mm long; anthers 1.2–2.4 mm long, 3–5 times longer than the filaments. CAPSULES ovoid, 3-locular, 2.5–4.2(–4.5) mm long, 1.1–1.6 mm wide, shorter than to longer than the tepals, light brown, smooth, shiny, the apices broadly rounded to acute, the mucro 0.3–0.8 mm long. SEEDS narrowly ovoid, 0.5–0.8 mm long, 0.3–0.4 mm wide, greyish to dark amber, reticulate, not tailed, the ends minutely apiculate. 2n = unknown. [*J. arcticus* Willdenow var. *mexicanus* (Willdenow ex Roemer & Schultes) Balslev, *J. balticus* Willdenow var. *mexicanus* (Willdenow ex Roemer & Schultes) Kuntze].—Wet meadows, stream banks and lakeshores, marshy areas, ditches, and open wetlands, often in alkaline areas, tolerating soils that dry out seasonally; widespread in AZ at mid to higher elevations: all cos except for Greenlee, La Paz, and Yuma; 600–2850 m (2000–9300 ft.); May–Aug; CA, CO, NM, NV, UT; Mex., C. & S. Amer. SUBGENUS *Poiophylli*; SECTION *Juncotypus*.

Juncus mexicanus is usually a more delicate plant than *J. balticus*, with shorter, thinner culms, smaller inflorescences, flowers, and capsules. See discussion under *J. balticus*.

Juncus nevadensis S. Watson (for the Sierra Nevada Mountains) Sierra rush.—Plants perennial with culms single to several clumped, often from long rhizomes 0.7–1.8 mm thick with internodes up to 3 cm long between culms. CULMS terete, 14–70 cm tall, 0.5–2 mm thick, clearly much exceeding most leaves; cauline leaf producing nodes present. BLADELESS SHEATHS 0–1, tan to maroon, the margins broadly rounded, scarious, the tip with a short awn. LEAVES cauline only, 2-4; auricles rounded, 1–2.6[–3.2] mm long, membranous; blades terete to flattened, hollow, 1–20(–30) cm long, few leaves reaching to 80% of culm heights, 0.5–2.3 mm wide, perfectly septate with crosswalls visible externally, green, the tips brown. INFLORESCENCE terminal, 1–4(–10) cm long, variable, from compact with 1-2 heads, each with many (15–60) flowers, to elongate with several branches and up to 10 heads, each with few (3–10) flowers; heads obconic to nearly globose, (3–)20–60 flowered, 5–12 mm wide, dark brown to blackish, composed of short branches, each with a scarious, awn-tipped basal bract; proximal bract erect to spreading, often with a long sheath, terete, 0.7–7.5 cm long, shorter to longer than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals broadly lanceolate, 2.4–4 mm long, dark brown, the margins scarious, the tips acute to awned, the awns to 0.8 mm; inner tepals slightly shorter than the outer; stamens 6; filaments 0.8–1.2 mm long; anthers 0.5–1.2 mm long, 0.6–1.5 times filament length. CAPSULES broadly ellipsoid to obovoid, broadest at or above the middle, imperfectly 3-locular, 2.0–3.7 mm long, 1.2–1.4mm wide, slightly shorter than to slightly longer than the tepals, chestnut brown, the apices broadly rounded, truncate or slightly retuse, the mucro 0.1–0.5 mm long. SEEDS narrowly to broadly ellipsoid, 0.4–0.5 mm long, 0.2–0.3 mm wide, yellow, reticulate, not tailed, the ends apiculate. 2n = unknown. [*J. badius* Suksdorf, *J. mertensianus* var. *badius* (Suksdorf) F.J. Hermann, *J. nevadensis* var. *badius* (Suksdorf) C.L. Hitchcock].—Wet soil along stream banks and lakeshores, montane meadows, springs, marshy areas, sometimes in standing water: Apache, Coconino, Greenlee, Navajo, and Yavapai cos; 1950–3050 m (6400–10,000 ft.); Jun–Aug; throughout w U.S.; extreme sw Can. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus nevadensis is most closely related to *J. mertensianus,* with which 1-2 headed plants have been confused in the past in AZ. *Juncus nevadensis* is a variable species in terms of its

inflorescence, ranging from single, subspherical, many-flowered heads to open panicles of few-flowered obconic heads, while *J. mertensianus* always has single (or rarely two) proximate, hemispheric to subspherical heads. *Juncus nevadensis* is a long-rhizomatous plant with taller, more isolated culms, compared to *J. mertensianus*, which is a short-rhizomatous plant with shorter, more bunched culms. *Juncus nevadensis* grows in montane meadows, usually in Ponderosa Pine to Mixed Conifer Forests, while *J. mertensianus* grows in Subalpine to Alpine Tundra. The anthers of *J. nevadensis* are generally equal to or longer than the filaments, while those of *J. mertensianus* are typically much shorter than the filaments, though these are not always present for diagnosis. Our current understanding is that the plants in AZ previously thought of as *J. mertensianus* are *J. nevadensis*, with *J. mertensianus* now excluded from AZ. In AZ, the prevalent form of *J. nevadensis* has 1–2 heads, though we find a continuous range of inflorescences to those with up to 10 heads. Arizona plants have a strongly rhizomatous habit, with auricles usually longer than 1.5 mm, while those of *J. mertensianus* are less than 1.2 mm. Our interpretation of the two species changes the allowable ranges for number of flowers per head and/or number of heads for both species from that in previous literature (Brooks & Clemants 2000b, Hurd et al. 1997, Kirschner 2002, McDougall 1973), but the result is more consistent with growth habit and habitat preference. Molecular work might show that the AZ plants with 1-2 ball-shaped heads are worthy of taxonomic distinction from the more typical, widespread form of the species.

Juncus nodosus Linneaus (for the root nodules) Knotted rush, Tuberous rush.—Plants perennial, with culms single or few clumped together from long rhizomes 0.6–1.0[–1.2] mm thick, the internodes up to 7+ cm, with occasional small tuber-like segments. CULMS terete, [4–]15–35[–70] cm tall, 0.7–2.2 mm thick; cauline leaf producing nodes present. BLADELESS SHEATHS 0(–2), 1–3[–4] cm long, pink to grey, the tip blunt to acute. LEAVES both basal and cauline, basal 0-1, cauline 2–3[–4]; sheaths glabrous, somewhat glaucous; auricles rounded, 0.2–1.7 mm long, membranous to cartilaginous; blades terete or channeled above, hollow, 5–16[–30] cm long, 0.6–1.6 mm wide, erect to ascending, perfectly septate with crosswalls visible externally, the tips acuminate to rounded. INFLORESCENCE terminal, 1–4(–7) cm long, composed of (2–)3–9(–15) heads on ascending to erect (rarely widely spreading) branches; heads more or less globose, (3–)8–30-flowered, 5–10[–12] mm wide; bracts lanceolate, 3–19[–29] mm long, green (or tepal colored); proximal bract leaf-like, terete, [1–]2–11[–13] cm long, nearly equaling or usually longer than inflorescence, erect. FLOWERS lacking a pair of bracteoles; tepals lanceolate-subulate, 2.4–3.5(–4.1)[–4.5] mm long, green to light brown, often red-tinged, the tip acuminate; inner tepals slightly longer (to slightly shorter) than the outer; stamens 3 or 6; filaments 0.6–1.3 mm long; anthers 0.4–0.7 mm long, ½ as long to as long as the filaments. CAPSULES lance-subulate in outline, unilocular, 3.2–4.5 mm long, 0.6–0.8 mm wide, longer than the tepals, light gold to castaneous-brown, the beak often sharply trigonous in cross section, the apices long-tapered. SEEDS ellipsoid, 0.4–0.5 mm long, 0.15–0.3 mm wide, yellow to brown, reticulate, not tailed, apiculate. 2n = 40.—Stream banks and lakeshores, wet meadows, swamps, ditches, and open wetlands; only known in AZ from south of Springerville in e AZ, and in far nw AZ: Apache and Mohave cos.; 550–2250 m (1800–7400 ft.); Jul–Sept; widespread from AK to e Can., throughout the ne U.S. to the Rocky Mts., absent from the se U.S. and most of the sw U.S., barely entering n AZ & NM; disjunct in Mex. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus nodosus is rare in AZ and has often been confused with depauperate specimens of *J. torreyi*, its closest relative in AZ. *Juncus nodosus* is generally a smaller plant, with tepals usually less than 4 mm long, while those of *J. torreyi* are more than 4 mm. The most striking difference is the fewer flowered heads (6–30 flowers), which look more "spikey" than those of *J. torreyi* (25–100 flowers), which look more smoothly spherical due to the large number of flowers, even though the flowers and capsules of both are just as pointed. The upper leaf blades in *J. nodosus* are ascending, while those of mature *J. torreyi* are always spreading to 45 degrees or more from the culm axis. This is not always apparent on herbarium specimens due to the way the plants were collected and folded on the sheet. The rhizomes of *J. nodosus* are also finer.

Juncus saximontanus A. Nelson (from the Latin saxum, for rock, and montes, for mountains) Rocky Mountain rush.—Plants perennial, with culms single or more frequently a few clumped from long rhizomes 1.2–2.0 mm thick; rhizomes light-colored, with internodes between culms mostly less than 1 cm, but up to 3 cm. CULMS compressed, 13–70 cm tall, 1.4–2.2 mm thick near the base, finely and irregularly striate; cauline leaf producing nodes present. BLADELESS SHEATHS 0, basal portion of the sheaths sometimes red. LEAVES both basal and cauline, basal 1–3, cauline 2–6; all green with broad hyaline margins, the margins narrowing distally on the blade; auricles 0–0.6; blades iris-like, folded lengthwise with the leaf edges toward the culm, fully connate (fused) above the auricles, 3–20 cm long, 1–6 mm wide, longitudinally ridged, imperfectly septate, the partial crosswalls often visible externally in dried specimens. INFLORESCENCE terminal, 1–16 cm long, 1–4(–8) cm wide, variable, from compact with few branches and few (2) heads with many (15-40+) flowers, to elongate with many branches and many (35-50) heads with few (2-20) flowers; heads usually hemispheric but sometimes with flowers spreading, subtended by 2–4 ovate hyaline bracts; branches subtended by a single lanceolate brownish-hyaline bract; proximal inflorescence bract leaflike, 10-45 mm long, usually shorter than the inflorescence, sometimes longer. FLOWERS lacking a pair of bracteoles; tepals lanceolate, 2.7–3.6 mm long, the tips acuminate, green to brown or slightly reddish brown; outer tepals slightly longer than the inner tepals; stamens 6; filaments 0.8–1.6 mm long; anthers 0.6–0.8 mm long. CAPSULES ellipsoid, unilocular, 2.4–4.3 mm long, 1.0–1.2 mm wide, slightly longer than the tepals, deep brown, smooth, shiny, the apices rounded to acute, the mucro 0.2–0.5 mm long. SEEDS ellipsoid, 0.4–0.5[–1] mm long, 0.2 mm wide, light brown, dark-tipped, reticulate-veined, not tailed, the ends apiculate. 2n = unknown. [*J. ensifolius* Wikstrom var. *montanus* (Engelmann) C. L. Hitchcock, *J. ensifolius* Wickstrom var. *brunnescens* (Rydberg) Cronquist, *J. tracyi* Rydberg, *J. xiphioides* E. Meyer var. *montanus* Engelmann].—Wet meadows, stream banks and lakeshores, marshy areas, ditches, and open wetlands; widespread in AZ at mid to high elevations: all AZ cos except for La Paz and Yuma; 400–3150 m (1400–10,300 ft.); Apr–Oct; from the Pacific Northwest to the Rocky Mts., absent from most of CA; in Can., extreme s BC and AB; Mex. s to Pue. & Ver. SUBGENUS *Juncus*; SECTION *Iridifolii*.

Juncus saximontanus is one of the more common and widespread rushes in Arizona. It also has the widest range of inflorescence shapes of any AZ species, with a continuum between a few compact, dark, ball-like heads to many paler small glomerules in a diffuse panicle. The extremes have been described as different varieties, but current taxonomic concepts describe them as one variable species. *Juncus saximontanus* has been considered a variety of *J. ensifolius* Wikstrom (Brooks & Clemants 2000b). However, we are following the more recent

Kirchner (2002) and Zika (2012) in maintaining it at species level. Few headed *J. saximontanus* plants are distinguished from *J. ensifolius* by having six stamens rather than three. Otherwise, the two are similar. *Juncus ensifolius* is a more northern taxon, not reaching as far south as AZ. It usually has a compact inflorescence with just a few (rarely up to 10) dark heads, appearing like the compact form of *J. saximontanus* in AZ. However, all of the AZ specimens we have examined with this form have six stamens.

In AZ, *Juncus saximontanus* is most closely allied to and often confused with *J. xiphioides,* a taller, more robust species. It can usually be separated by the characters given in the key, but there are problematic intermediate specimens. In such cases, we have made determinations based on gestalt coupled with range and elevation; *J. xiphioides* occurs at lower elevations (below 5820 ft.) in Pinyon Juniper Woodland to Sonoran Desert Scrub, while *J. saximontanus* ranges up to Alpine Tundra. *Juncus xiphioides* always has many heads that are diffusely arranged, and that are not as dark as those of *J. saximontanus*.

Juncus tenuis Willdenow (thin, or figuratively, insignificant or poor, for the thin culms and leaves) Poverty rush, Slender rush, Path rush.—Plants perennial, cespitose from short, densely branching rhizomes. CULMS terete, (10–)15–55(–80) cm tall, 0.5–1.5 mm thick, cauline leaf producing nodes lacking. BLADELESS SHEATHS 0–1[-2]. LEAVES all basal, (1–)2–3; sheaths loose, the margins scarious; auricles acute,1.5–6 mm long (late season growth can have shorter auricles), thin, membranous, translucent, delicate, often broken; blades flat with face toward culm to involute, 3–30 cm long, 0.5–1.7 mm wide. INFLORESCENCE terminal, 2–5(–9) cm long, compact and few-flowered to more open, composed of [5–]15–45 flowers, with 2–5 primary branches; proximal bract leaf-like, 2–13 cm long, usually longer than the inflorescence. FLOWERS borne singly; bracteoles 2, the bracteoles broadly ovate, 1.2–2.1 mm long, membranous, the tips subobtuse to acute; tepals lanceolate, 3.3–4.4 mm long, the midstripe broad, greenish, bordered with pale green, the margins membranous, the tips acuminate, often reddish; inner tepals approximately equal to minutely shorter than the outer; stamens 6; filaments 0.5–1.1 mm long; anthers (0.2–)0.4–0.7 mm long. CAPSULES ellipsoid, imperfectly 3-locular, the locules partitioned at the base only, 3.0–3.5[–4.7] mm long, 1.4 mm wide, shorter than the tepals, tan or light brown, the apices rounded to obtuse, top of the valve partitions not sharp-ridged, the capsules with a single chamber, the locular partitions separated except at base, the mucro to 0.3 mm long. SEEDS ellipsoid to lunate, 0.3–0.5 mm long, 0.2 mm wide, tan to dark brown, faintly reticulate, not tailed, the ends apiculate. 2n = 84.—Moist areas along stream banks and around springs: Coconino, Gila, Graham, and Yavapai cos; 2000–2750 m (6500–9100 ft.); May–Sept; throughout the U.S., except absent from the Great Basin, s TX, and s FL; s Can. SUBGENUS *Poiophylli*; SECTION *Steirochloa*.

Juncus tenuis is one of several look-a-like rushes in Subgenus *Poiophylli*. Some floras (Kearny & Peebles 1960; Cronquist 1977; Hurd, Goodrich, & Shaw 1997) have included both *J. dudleyi* and/or *J. interior* in a broadly defined *J. tenuis*, and consequently, there are many specimens throughout the western and central US that have been called *J. tenuis*. However, as currently accepted (Brooks & Clemants 2000b, Kirschner 2002, Zika 2012) in a more narrow sense, *J. tenuis* is rare in the Southwest, known in AZ from only a few widely scattered locations. It is also important to know that in *J. tenuis*, the first flush of growth develops the typical and characteristic elongate sharp-pointed translucent auricles; however, the same tuft can produce a second flush of foliage, later in the season, which mostly have auricles blunt and

short; this deceives many who do not think to look at the older growth for the characteristic auricles. See further discussion under *J. confusus*, *J. dichotomus*, *J. dudleyi*, and *J. interior*.

Juncus torreyi Coville (for John Torrey, 1796–1873, an American physician and botanist) Torrey's rush.—Plants perennial, with culms single or few clumped together from long rhizomes, these 1–2.5[–3] mm thick, with tuberous nodes, the internodes between culms up to 8+ cm. CULMS terete, [3–]15–90[–100] cm tall, 1–4[–6] mm thick; cauline leaf producing nodes present. BLADELESS SHEATHS 0. LEAVES both basal and cauline, basal 1[–3], cauline 2–4[–5], all with blades; sheaths glabrous, glaucous; auricles rounded, [1–]2.0–4.2 [–5] mm long, scarious, sometimes connected behind the culm forming a true ligule; blades terete or channeled above, hollow, 6–50 cm long, (0.5–)1–2.2(–4)[–5] mm wide, perfectly septate with crosswalls visible externally, the tips acute, the upper stem leaves stiff divaricate. INFLORESCENCE terminal, 2–5.5 cm long, composed of (1–)2–12(–20) heads on ascending to spreading branches, the heads more or less globose, (8–)10–15 mm wide, 25–100-flowered; proximal bract leaf-like, terete, 1–13 cm long, longer (rarely less) than inflorescence, erect to more rarely spreading or descending. FLOWERS lacking a pair of bracteoles; tepals lanceolate-subulate, 4–5 mm long, green to straw, often reddish, the tips acuminate; inner tepals slightly shorter than the outer, subequal to the capsules; stamens 6; filaments 1.0 mm long; anthers 0.4–0.6 mm long, less than ½ as long as the filaments. CAPSULES lance-subulate in outline, narrowly tapered to acute apices, the beaks often sharply trigonous in cross section, imperfectly 3-locular, 4–5.1[–5.7] mm long, 0.7–0.9 mm wide, straw to chestnut-brown or shiny coppery, the apices long-tapered. SEEDS ellipsoid, 0.4–0.5 mm long, 0.25–0.3 mm wide, golden-brown, finely reticulate, with longitudinal ridges, not tailed, apiculate. 2n = 40. [*J. nodosus* L. var. *megacephalus* Torreyi].—Stream banks and lakeshores, wet meadows, swamps, ditches, and open wetlands, alkaline locations: all AZ cos except Greenlee, absent from the extreme sw desert except along the Colorado River corridor; 0–2300 m (300–7600 ft.); May–Sept; widespread throughout most of the U.S., excluding the se U.S. and Pacific Coast; extreme s Can.; Baja C. & n Mex. SUBGENUS *Juncus*; SECTION *Ozophyllum*.

Juncus torreyi is common throughout AZ, typically at lower elevations, and barely entering the Ponderosa Pine zone along the Mogollon Rim and in the Chuska Mts. Small specimens have been confused with *J. nodosus*, which is rare in AZ (see discussion under *J. nodosus*). It can also be confused with *J. acuminatus*, also in SECTION *Ozophyllum*, which has the same terete, septate leaves, and inflorescence of globose clusters. However, *J. acuminatus* is clump-forming, not rhizomatous as is *J. torreyi*, and *J. acuminatus* has capsules with acute apices, not subulate as in *J. torreyi*. The tepals of *J. acuminatus* are generally less than 3.5 mm long, while those of *J. torreyi* are 4 mm or greater.

Juncus xiphioides E. Meyer (from the Greek xiphos, for sword, as in the sword-like leaf blades) Irisleaf rush.—Plants perennial, with culms single, or more frequently, a few clumped from long rhizomes; rhizomes light-colored, 1.5–4.5 mm thick, with internodes between culms up to 5 cm long. CULMS compressed, (25–)35–90(–110) cm tall, 1.5–4(–6) mm wide near the base; cauline leaf producing nodes present. BLADELESS SHEATHS 0–2(–3), often green. LEAVES both basal and cauline, basal 1–3, cauline 2–6, pale green, with broad hyaline margins that narrow distally on the blade; auricles lacking; blades iris-like, folded lengthwise with the leaf edges toward the culm, fully connate, 10–25(–40) cm long, 3–9(–12) mm wide, imperfectly septate, the partial crosswalls often visible externally in dried specimens.

INFLORESCENCE terminal, diffuse, (4–)6–23 cm long, 3–11 cm wide, composed of (20–) 40–160+ heads with 1–4 primary branches, each branch subtended by a shorter leaf-like bract the heads with 5–20 flowers (up to 70 when congested in larger heads), subtended by 2–6 ovate hyaline bracts; proximal inflorescence bracts 2–4(–7) cm long, shorter than the inflorescence. FLOWERS lacking a pair of bracteoles; tepals lanceolate, 2.4–3.7 mm long, green to brown or deeply reddish brown, the tips acuminate, often red; outer tepals subequal to or slightly longer than the inner tepals; stamens 6; filaments 0.6-1.0 mm long; anthers 0.5–0.9 mm long, ½ as long to as long as the filaments. CAPSULES narrowly prismatic-trigonous, acuminate to narrowly acute, unilocular, 2.4–3.8 mm long, 0.6 mm wide, slightly longer than the tepals, light to deep brown, smooth, shiny, the apices acute, the mucro 0.4–0.6 mm long. SEEDS ellipsoid, 0.4–0.5 mm long, 0.2 mm wide, yellow to light brown, dark-tipped, reticulate, not tailed, apiculate at both ends. 2n = 40.—Wet meadows, stream banks and lakeshores, marshy areas, ditches, and open wetlands; found in AZ at lower to mid-elevations: Coconino, Gila, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, and Yavapai cos; 350–1800 m (1200–5900 ft.); May–Aug; se CA, extreme s NV & UT, barely entering w NM; n Mex. & Baja C. SUBGENUS *Juncus*; SECTION *Iridifolii*.

Juncus xiphioides is most likely to be confused with *J. saximontanus*. See discussion under *Juncus saximontanus*.

Luzula de Candolle Woodrush

Plants grass-like, perennial in ours, densely cespitose from short rhizomes or less commonly with short stolons. CULMS round in cross section, hollow or with longitudinal septa, leafy (in ours). LEAVES basal and cauline (in ours), spirally arranged, clustered at base, reduced up the culm; bladeless sheaths (cataphylls) lacking; sheaths closed, without auricles; blades linear to lanceolate, flat with face towards the culm (grass-like), never septate, the margins sparsely to densely ciliate (at least basally), the hairs long, soft, simple. INFLORESCENCES terminal, cymose, diffuse to congested, sometimes with one to many racemose or paniculate clusters (glomerules per some treatments); branches and clusters with bracts; proximal inflorescence bracts shorter to longer than the inflorescence, or sometimes reduced to a scale. FLOWERS perfect, with 2 bracteoles subtending each flower, the bracteoles entire to lacerate, fringed or ciliate; perianth of six tepals, three outer (sepals) and three inner (petals), small, tan to dark brown, usually persistent at fruiting; stamens 6 (in ours); filaments shorter to longer than the anthers; ovary superior; style 1; stigmas 3. CAPSULES globose to ovoid-trigonous, with beak formed by persistent style base, uni-locular, containing 3 seeds. SEEDS globose to ovoid, sometimes with a short appendage (caruncle) at the base.—ca. 115 species worldwide, but rare in the tropics, ca. 23 listed in the Flora of North America, 4 in AZ. (from the Latin *gramen luzulae* or *luxulae*, the diminutive of *lux*, light, for the shiny hairs of some species). Principal references: Swab (2000), Kirschner (2002).

1. Flowers borne singly or several together on long, slender branches in an open,drooping panicle; leaves 4–13 mm wide, sparsely ciliate at the throat .....***Luzula parviflora***

1’ Flowers borne in congested clusters, each cluster with (3) 5–20(+) sessile or nearly sessile flowers; leaves 0.4–6 mm wide, obviously ciliate along the lower margins.

2. Flower clusters tightly clustered and sessile to short pedunculate on a nearly continuous inflorescence; inflorescence often nodding at maturity; plants of drier areas in open subalpine forests to alpine tundra ..... ***Luzula spicata***
2' Flower clusters mostly widely separated on unequal, stiff peduncles; inflorescence strictly upright at maturity; plants of mesic areas in montane forests and meadows.
3. Tepals and capsules light bronze when mature; flower clusters tending to be about as long as wide (3–)5–7(–9) long; upper culm leaves, peduncles and bracts persistently green .....***Luzula comosa***
3' Tepals and capsules brown when mature; flower clusters tending to be longer than wide (4–)6–14 mm long; upper culm leaves, peduncles and bracts usually maturing to red..... ***Luzula multiflora***

Luzula comosa E. Meyer (Latin *coma*, from the Greek kome, hair, and *osa*, abundance; furnished with a tuft of hairs, or also of flowers, bracts, etc.) Pacific woodrush.—Plants perennial, cespitose from very short vertical rhizomes (rarely apparent). CULMS terete to flattened, 10–55 cm tall, 0.4–1.4 mm thick, 4–12 ribbed. LEAVES with flat blades, the faces glabrous, the margins ciliate with long soft wavy hairs, the tips obtuse, thickened, more or less callous; basal blades 5–15 cm long, 1–5(–7) mm wide; cauline blades 1–3(-4), 2–12 cm long, 2–6 mm wide, yellowish to bright green. INFLORESCENCE usually open, 2–14 cm long, stiffly upright at maturity, composed of 1–2(–4) subsessile and 2–7 unequal, stiffly ascending to spreading pedunculate floral clusters, (3–)5–7(–9) mm long, 5–7 mm wide; proximal bract leaf-like, 1.5–5 cm long, usually shorter than the mature inflorescence, the margins ciliate. FLOWERS 3–12 per cluster, the bracteoles clear to straw-colored, subentire to fringed or ciliate; tepals lanceolate, 2.5–3.5 mm long, light bronze to scarious, similar in length and shape, the tips acuminate; stamens 6; anthers 0.3–0.7, shorter than to subequal to the filaments. CAPSULES obovoid, 2–2.5 mm long, subequal to the tepals, bronze, the apices obtuse with a short apiculus. SEEDS narrowly ovoid, 1.1–1.5 mm long, brown to reddish-brown; the appendage 0.1–0.2 mm long. 2n = 12.—2 vars.; AZ plants belong to var. ***laxa*** Buchenau, which has the open inflorescence described above, while var. *comosa* of the Pacific Coast has a more congested inflorescence.—Meadows and forest glades, wooded slopes, in moist to shaded soils, along the Mogollon Rim, and in the Pinaleno, Rincon, and Santa Catalina mountains: Coconino, Graham, and Pima cos.; 2100–3150 m (7000–10,300 ft.); May–Aug; from s BC, Can. down the Pacific Coast to CA and from MT s through the Rocky Mts. to AZ & NM. SUBGENUS *Luzula*; Section *Luzula*.

Luzula comosa var. *laxa* is extremely similar to the predominantly European and w Asian *L. multiflora*, which (according to Kirschner et. all. 2002) has been introduced in various parts of N. Amer. Plants from the White Mtns. with darker inflorescences and longer flower clusters have been identified as *Luzula multiflora* and can be separated using the characters in the key. Kirschner (2002) uses minute papillae (at 80x) on the peduncles of *Luzula multiflora* to separate the two, but we have not been able to discern this in our specimens. Swab (2000) uses degree of spreading in the peduncles, with those of *Luzula comosa* var. *laxa* more divergent, but our specimens cannot be separated using this character. Zika (2012) describes bulbous culm bases for *Luzula comosa* var. *laxa*, and *L. multiflora* as lacking bulbous bases, but we have not been able to see this character. We are retaining the two as distinct because they also

separate by range in AZ. Further work is needed to develop a clearer understanding of this species pair.

Luzula multiflora (Ehrhart) Lejeune (Latin *multus*, many, and *floris*, a flower; many-flowered) Common woodrush.—Plants perennial, cespitose from short vertical rhizomes. CULMS terete to flattened, 4–12 ribbed, 9–40 cm tall, 0.4–1.4 mm thick. LEAVES with flat blades, the faces glabrous, the margins with long soft wavy hairs, the tips obtuse, thickened, more or less callous; basal blades 2–12 cm long, 1–5 mm wide; cauline blades 1–3(–4), 2–10 cm long, 2–5 mm wide, thickened, more or less callous, yellowish to bright green. INFLORESCENCE usually open, 2–5(–10) cm long, stiffly upright at maturity, composed of 1–2 subsessile and 3–10(–12) unequal, stiffly ascending to spreading, pedunculate, elongate floral clusters (4–)6–14 mm long, 3–6 mm wide; proximal bract leaf-like, 1–7 cm long, usually shorter than the mature inflorescence, the margins entire to ciliate. FLOWERS (3–)8–16 per cluster, the bracteoles scarious, subentire to fringed or ciliate; tepals lanceolate, 2.2–3 mm long, brown with scarious margins, similar in size and shape, the tips acute to acuminate; stamens 6; anthers 0.3–0.8 mm long, shorter than to subequal to the filaments. CAPSULES obovoid, 2–2.2 mm long, slightly shorter to longer than the tepals, brown, glossy, the apices obtuse with a short apiculus. SEEDS narrowly ovoid, 0.8–1 mm long, brown to reddish-brown, the appendage 0.1–0.2 mm long. 2n = 24. —6 subsp., 2 in the U.S.; AZ plants belong to subsp. ***multiflora***, which differs from subsp. *frigida* (Buchen.) V. I. Krecz of ne U.S. and CAN in having capsules more obtuse than acuminate, and shorter rather than longer than the tepals.—Wet meadows and bogs; known from the White Mts. in AZ: Apache and Greenlee cos.; 2200–3000 m (7300–10,000 ft.); Jun–Aug; Widespread in Can., the n U.S., and widely scattered elsewhere. SUBGENUS *Luzula*; Section *Luzula*.

See comments under *Luzula comosa* var. *laxa*. Based on the pristine habitats where we find *L. multiflora* plants in Arizona, to us, it seems unlikely that they are introduced. The possibility remains that our plants differ from the general concept of *L. multiflora*.

Luzula parviflora (Ehrhart) Desvaux (Latin *parvus*, little or small, and *floris*, a flower; small-flowered) Smallflowered woodrush.—Plants perennial, cespitose from short vertical rhizomes. CULMS terete, (8–)30–70(–100) cm tall, 1–3 mm thick. LEAVES with flat blades, predominantly glabrous, with long soft hairs at the throat, dull green, the tip acute to acuminate, not thickened; basal blades 3–7 cm long, 5-10 mm wide; cauline blades 3–6, 8–17 cm long, 4–10(–13) mm wide. INFLORESCENCE usually diffuse with 1–4 primary branches, 4–14[–20] cm long, with 30–150+ floral clusters, usually lax and nodding when mature; bracts smaller and more scale-like upwards; proximal bracts leaf-like, 1–6 cm long, shorter than the mature inflorescence, with closed sheaths 4–10 mm long. FLOWERS 1–4 per cluster, the bracteoles clear to brownish, entire to lacerate; tepals broadly lanceolate, 1.8–2.7 mm long, clear to dark brown, the tip acute; stamens 6; anthers 0.5–0.8 mm, shorter than to as long as the filaments. CAPSULES globose, up to 2.7 mm long, as long to longer than the tepals, green fading to beige (dark brown), glossy, the apiculus short. SEEDS ellipsoid, 1.1–1.5 mm long, brown to reddish or purplish-brown. 2n = 24. [*Juncus parviflorus* Ehrhart].—Meadows and forest glades, wooded slopes, in moist and shaded locations, at higher elevations, in the San Francisco Peaks, and the Pinaleno and White mountains, with one record from the Mogollon Rim: Apache, Coconino, and Graham cos. (to be expected in Greenlee and Navajo cos.); 2250–3500

m (7500–11,500 ft.); Apr–Aug; throughout AK and Can., down the Pacific Coast to n CA and the Sierra Nevada, and s through the Rocky Mts. to AZ & NM. SUBGENUS Anthelaea.

Luzula parviflora is the most common woodrush in AZ and is unlikely to be mistaken here for any other species in this genus. Kirschner (2002) recognizes three subspecies of *Luzula parviflora*, two of which he reports from AZ, subsp. *parviflora* and subsp. *fastigiata* (E. May) Hamet-Ahti. Kirschner uses the following characters to separate them:

1. Inflorescence many-flowered with short distal secondary branches, the branches ascending; tepals medium brown..... subsp. ***parviflora***
1'Inflorescence few-flowered, with long distal secondary branches; the branches almost divaricate; tepals usually pale brown to stramineous ..... susbp. ***fastigiata***

AZ specimens have not been identified to subspecies in the herbaria that we reviewed. We did not find specimens that match the description of subsp. *fastigiata*. Swab (2000) did not recognize subspecies of *Luzula parviflora* in their treatment for the Flora of North America. It appears to us that all specimens of *Luzula parviflora* in AZ belong to the same taxon, and while we do not have enough experience in the other parts of its range to judge the validity of subspecies, we are not recognizing subspecies in AZ.

Luzula spicata (Linneaus) de Candolle (Latin *spica*, a point or spike, and *ata*, possession of; spiked or spike-like, for the inflorescence) Spiked woodrush.—Plants perennial, single or several-stemmed to densely cespitose from very short vertical rhizomes. CULMS terete, [3–] 5–27[–33] cm tall, 0.5–1.0 mm thick. LEAVES with blades flat to somewhat channeled, predominantly glabrous, the junction of sheath and blade with long white intertangled hairs, the lower margins with sparse hairs, pale to bright green, the tips blunt to acute, not or minimally thickened; basal blades 2–15 cm long, 0.4–4 mm wide; cauline blades 1–3, 1–10 cm long, 0.5–4.5 mm wide; sheaths rarely reddish at the base. INFLORESCENCE dense, congested, 5–10 mm long, often nodding at maturity, composed of 3–7 overlapping inflorescence branches, the basal internode 2–6 mm; proximal bract leaf-like, 1–3 (–7) cm long, shorter than to longer than the mature inflorescence, the margins entire. FLOWERS 3–20+ per cluster, the floral bracts similar to bracteoles, but longer (to 6.5 mm), often long-awned; bracteoles clear with lacerate margins that disintegrate into tangled wooly hairs, long acuminate or awned; tepals 2–3 mm long, broadly lanceolate; inner tepals often shorter and narrower than outer tepals, the tips of inner tepals acute to long acuminate, the tips of the outer tepals long acuminate or awned to 1 mm, brown with clear margins or clear throughout; stamens 6; anthers 0.3–0.4 mm long, ½ as long to as long as the filaments. CAPSULES globose, 1.3–2.0 mm long, shorter than the tepals, green maturing to light tan (dark brown), glossy, the apices acute or with a short mucro. SEEDS cylindric-ovoid, 0.8–1.0 mm long, brown. 2n = 24. [*Juncus spicatus* Linneaus].—5 subsp., only subsp. ***spicata*** in the U.S., which differs from the Eurasian subsp. in having shorter anthers coupled with a more interrupted rather than compact inflorescence.—Dry alpine tundra to subalpine forests, San Francisco Peaks only in AZ: Coconino Co.; 3200–3700 m (10,800–12,000 ft.); Jul–Sep; circumpolar in the Arctic, s through BC in Can. to WA, OR & CA and through the Rocky Mts. to AZ & NM. SUBGENUS Luzula; SECTION Gymnodes.

Luzula spicata can easily be separated from its other relatives by its dense, nodding inflorescence that often looks fuzzy due to the prominent ciliate bracteoles and bristle-tipped outer tepals, and its alpine habitat.

EXCLUDED TAXA

The following eight taxa were previously either reported from, or mis-determined from Arizona. We currently do not believe these are present in the state:

Juncus arcticus Willdenow —See discussion under *Juncus balticus.*

Juncus effusus var. ***brunneus*** Engelman —Misapplied to both *Juncus laccatus* and *Juncus effusus* subsp. *austrocalifornicus* in AZ, and now considered a synonym for *Juncus hesperius*, a Pacific Coast species in this group.

Juncus ensifolius Wikström —See discussion under *Juncus saximontanus.*

Juncus filiformis L. —A more northern relative of *Juncus balticus* and *J. mexicanus*. AZ reports were based on misidentifications.

Juncus macrandrus Coville —A CA relative of *Juncus xiphioides*; mistakenly mapped for AZ in Brooks & Clemants (2002b); no AZ specimens exist.

Juncus mertensianus Bongard —See discussion under *Juncus nevadensis*.

Juncus occidentalis (Coville) Wiegand —A relative of *Juncus dudleyi* and *J. interior* from CA, ID, OR, and WA, reported from s AZ in Brooks & Clemants (2002b), but apparently in error (possibly based on misidentifications of the very similar looking *J. confusus*). No specimens can be found.

Juncus orthophyllus Coville —A relative of *Juncus longistylis* and *J. macrophyllus* from CA & NV. AZ reports were based on misidentifications.

Juncus sphaerocarpus Nees —A Mediterranean species whose name was mistakenly applied to AZ plants thought to belong to *Juncus bufonius* var. *occidentalis*, which is now not recognized as distinct from the species.

ACKNOWLEDGEMENTS

We borrowed specimens from, or visited and reviewed specimens in these herbaria in AZ: University of Arizona (ARIZ), Northern Arizona University (ASC), Arizona State University (ASU), Desert Botanical Garden (DES), Grand Canyon National Park (GCNP), Museum of Northern Arizona (MNA), Navajo Nation Herbarium (NAVA), Natural History Institute (NHI), Yavapai College (YCH), US Forest Service Southwestern Region (TEUI), and several other small Forest Service herbaria. In addition, we borrowed or visited and reviewed specimens from out-of-state herbaria including Brigham Young University (BRY), University of Colorado Museum (COLO), Dixie College, Field Museum of Chicago (F), Fort Lewis College (FLD), Missouri Botanical Garden (MO), New Mexico State University Herbarium (NMC), New York Botanical Garden (NY), University of Nevada at Reno (RENO), Rocky Mountain Herbarium (RM), San Juan College (SJNM), Dale A. Zimmerman Herbarium (SNM), University of California Riverside (UCR), University of New Mexico (UNM), and University of Texas at El Paso (UTEP). We also borrowed specimens from the private collections of Glenn Clifton (Kingman, AZ) and Arnold Clifford (Beclabito, NM).

Thanks to Tina Ayers, curator of the Deaver Herbarium (ASC) at NAU, for facilitating and hosting the many loans that we reviewed during the course of this project. Thanks also for the help and efforts of the other curators and collection managers of herbaria that curate AZ Juncaceae specimens that we reviewed. We could not have completed this project without the invaluable assistance and mentorship of Peter Zika (WTU). Bill Norris (SNM), Jim McGrath (Albuquerque, NM), Ries Lindley (Tucson, AZ), and Glenn Clifton (Kingman, AZ) also provided help and feedback. The USFS, Navajo Nation and Fort Huachuca Military Reservation facilitated permits for research and collecting on their lands. SEINet (2010-2018) was an indispensable resource for completing this work, and we thank Chief Programmer Ed Gilbert for his expertise and assistance. Maps were produced using Daryl Lafferty's program (pers. comm. 2018) from specimen data on SEINet.

SELECTED REFERENCES

BROOKS, R. E. and S. E. CLEMANTS. 2000a. Juncaceae. pp. 211–267. In: Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico. Vol. 22: Magnoliophyta: Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

CRONQUIST, A. 1977. Juncaceae. pp. 47–67. In: Intermountain Flora, A. Cronquist, N. H. Holmgren, J. L. Reveal, P. K. Holmgren (eds.). Vol. 6. Columbia University Press, New York, NY.

HURD, E., S. GOODRICH, and N. L. SHAW. 1997. Field Guide to Intermountain Rushes. U. S. Department of Agriculture, General Technical Report INT-306.

HERMANN, F. J. 1960. Juncaceae. pp. 168–174. In: T.H. Kearny, R. H. Peebles, and collaborators, Arizona Flora. University of California Press, Berkeley, California.

JAMIESON, D. W. 2013. Juncaceae. pp. 605-610. In: Flora of the Four Corners region; Vascular Plants of the San Juan River Drainage; Arizona, Colorado, New Mexico, and Utah, K. D. Heil, S. L. O'Kane, L. M. Reeves, and A. Clifford (eds.). Missouri Botanical Garden Press, St. Louis, Missouri.

KIRSCHNER, J. et. all. 2002. Juncaceae. In: Species Plantarum, Flora of the World, A. E. Orchard and A. J. G. Wilson (eds.). Parts 6, 7, 8. Australian Biological Resources Study, Canberra, Australia.

KIRSCHNER, J. 2012. *Luzula*. pp. 1361–1374. In: The Jepson Manual, Vascular Plants of California, Second Edition, B. G. Baldwin, D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds.). University of California Press, Berkeley, California.

KNAPP, W. M. and F. C. NACZI. 2008. Taxonomy, Morphology, and Geographic Distribution of *Juncus longii* (*Juncaceae*). Systematic Botany 33(4): 685–694.

LEHR, J. H. 1978. A Catalogue of the Flora of Arizona. Desert Botanical Garden, Phoenix, Arizona.

SEINet Portal Network. 2018. http//:swbiodiversity.org/seinet/index.php. Accessed 2010-2018.

SNOGERUP, S., P. F. ZIKA, and J. KIRSCHNER. 2002. Taxonomic and nomenclatural notes on *Juncus*. Preslia, Praha 74: 247–266.

SWAB, J.C. 2000. *Luzula*. pp. 255–267. In: Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico. Vol. 22: Magnoliophyta: Arecidae, Commelinidae (in part), and Zingiberidae. Oxford University Press, New York, NY.

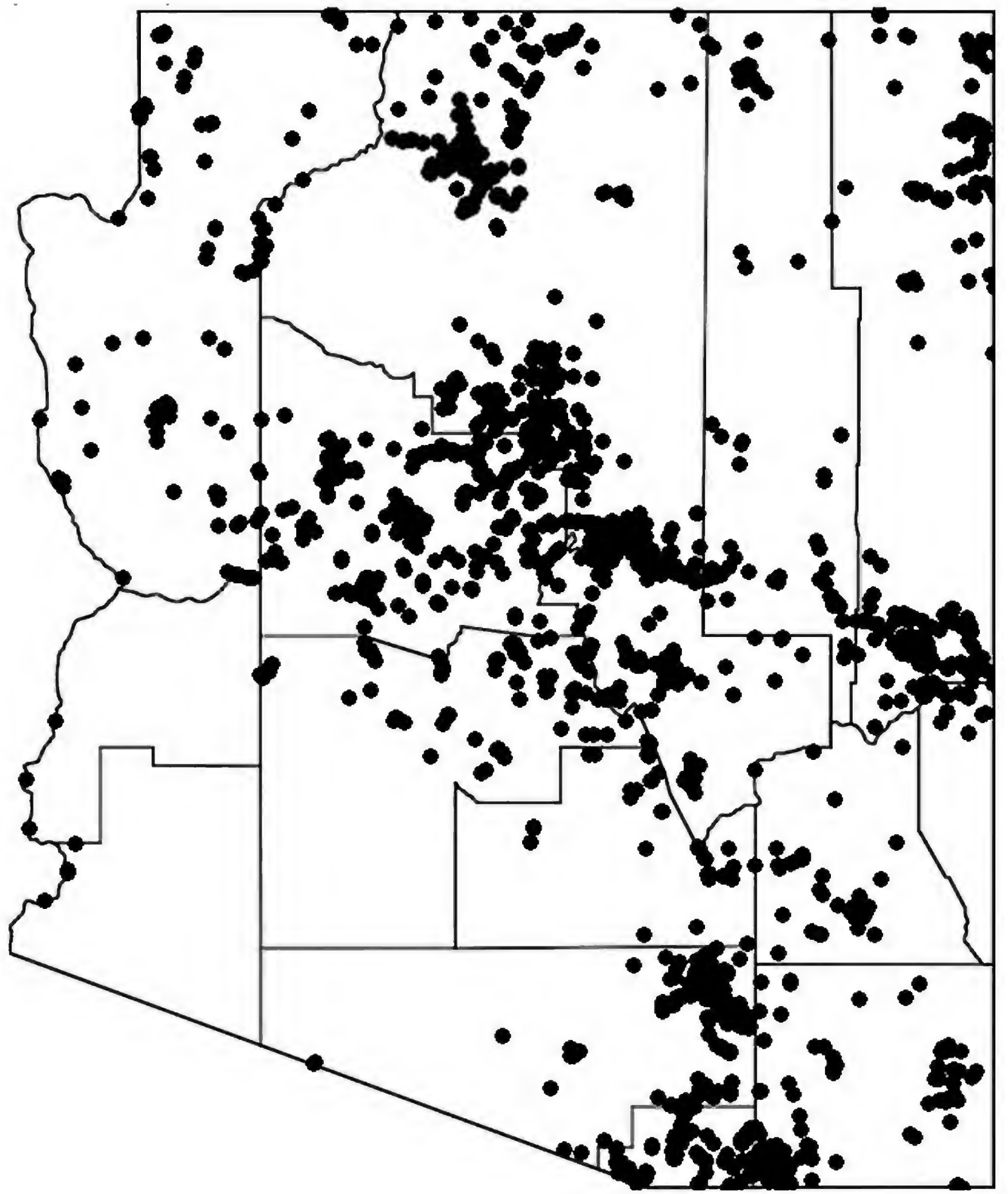
ZIKA, P. F. 2003. The native subspecies of *Juncus effusus* (*Juncaceae*) in western North America. Brittonia, 55(2): 150–156.

ZIKA, P. F. 2006. A Key to Section *Juncotypus* in British Columbia. Botanical Electronic News No. 358.

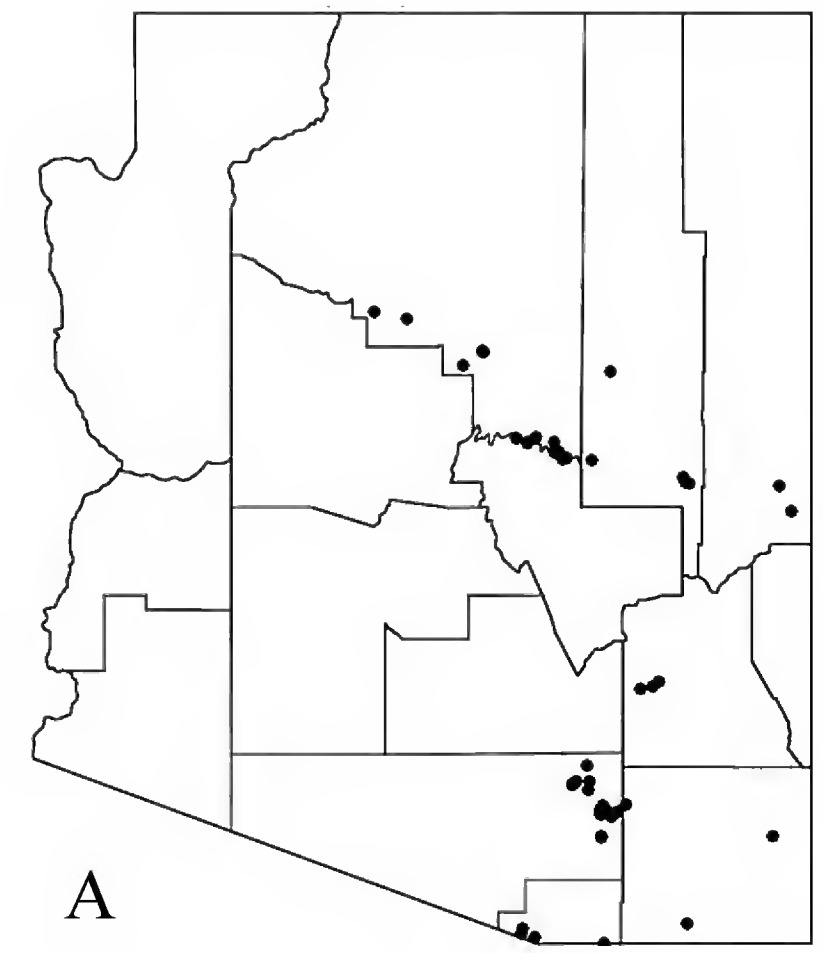
ZIKA, P. F. 2012. *Juncus*. pp. 1361–1374. In: The Jepson Manual, Vascular Plants of California, Second Edition, B. G. Baldwin, D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds.). University of California Press, Berkeley, California.

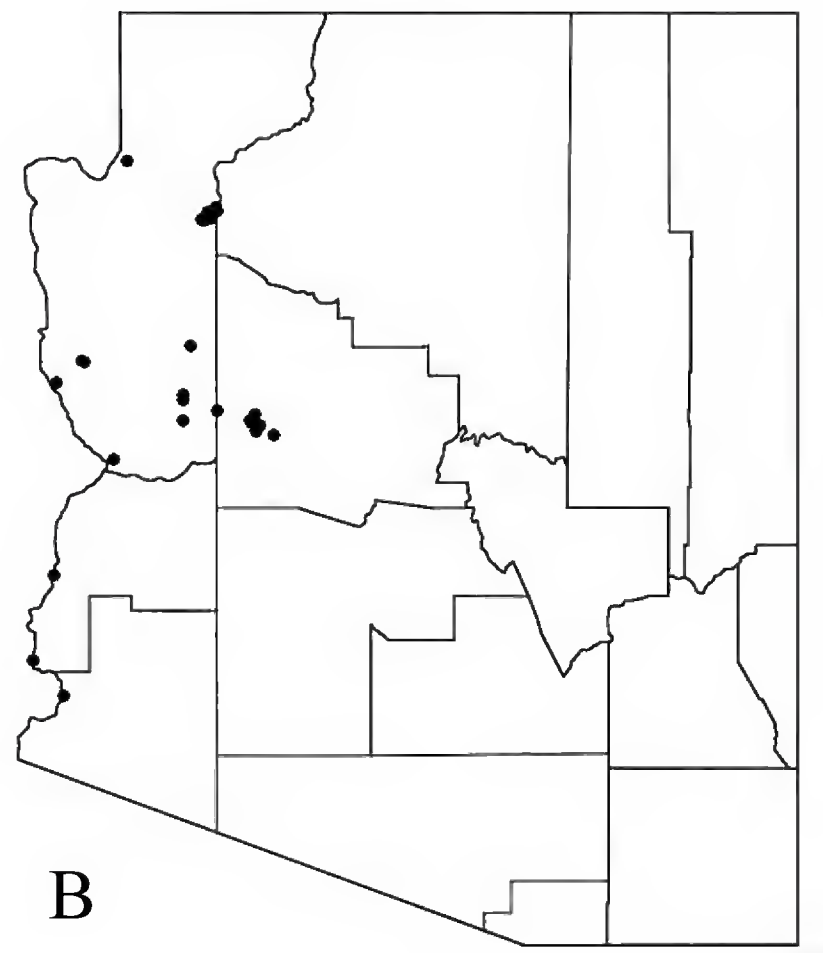
ZIKA, P. F. 2013. A Synopsis of the *Juncus hesperius* group (*Juncaceae, Juncotypus*) and their hybrids in western North America. Brittonia, 65(2): 128–141.

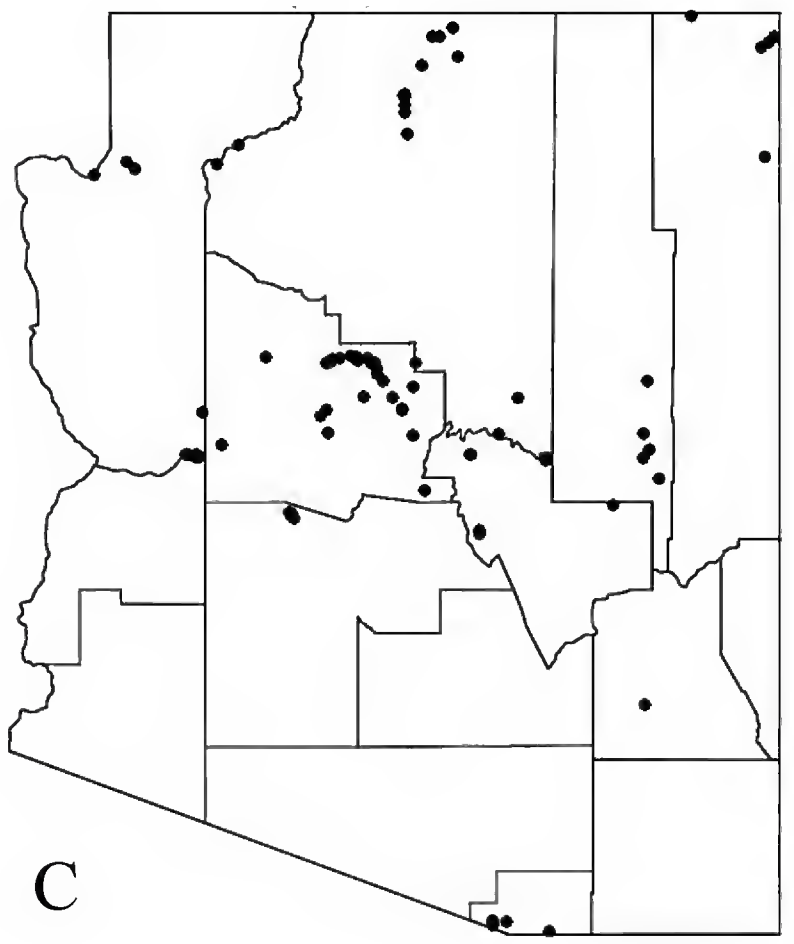
ZIKA, P. F. 2018. Juncacea*e*. pp. 711-720. In: C. L. Hitchcock and A. Cronquist, Flora of the Pacific Northwest, An Illustrated Manual, Second Edition, D. E. Giblin, B. S. Legler, P. F. Zika, and R. G Olmstead (eds.). University of Washington Press, Seattle, Washington.

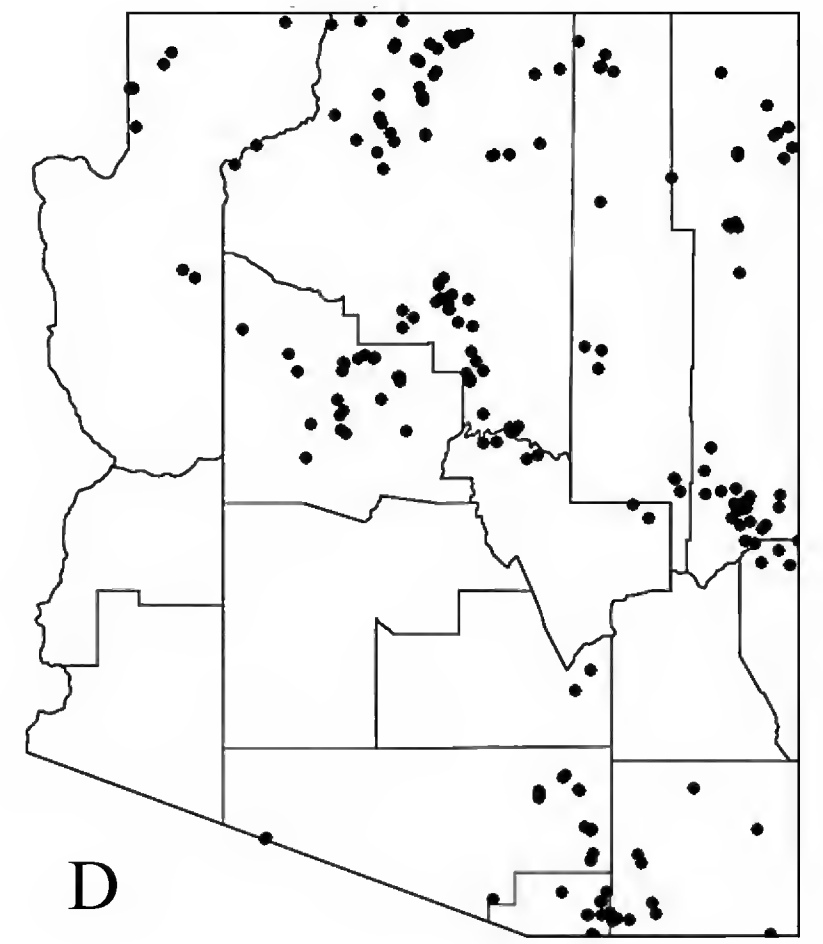


Juncaceae Figure 1. Distribution of: all *Juncus* species in Arizona

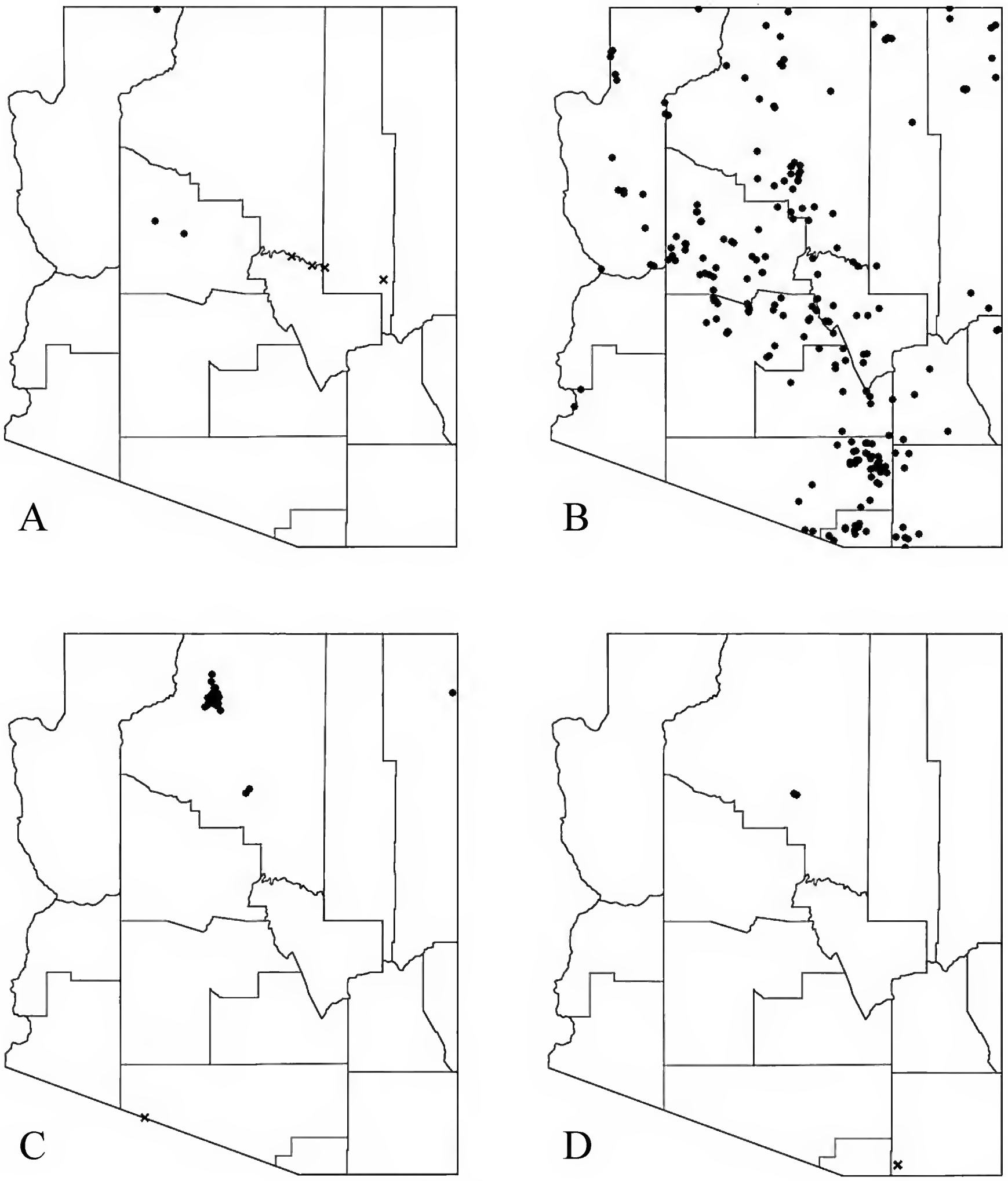




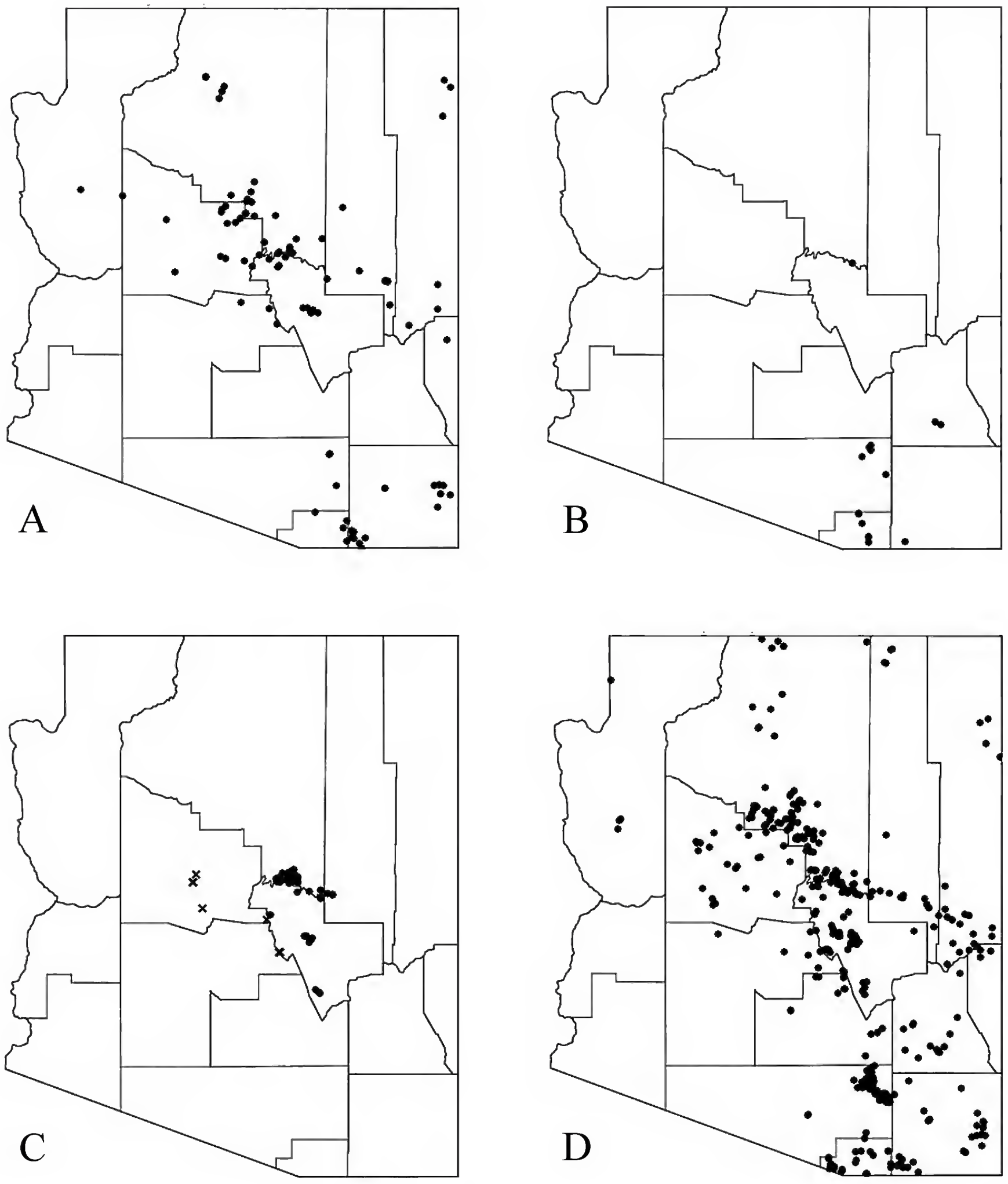




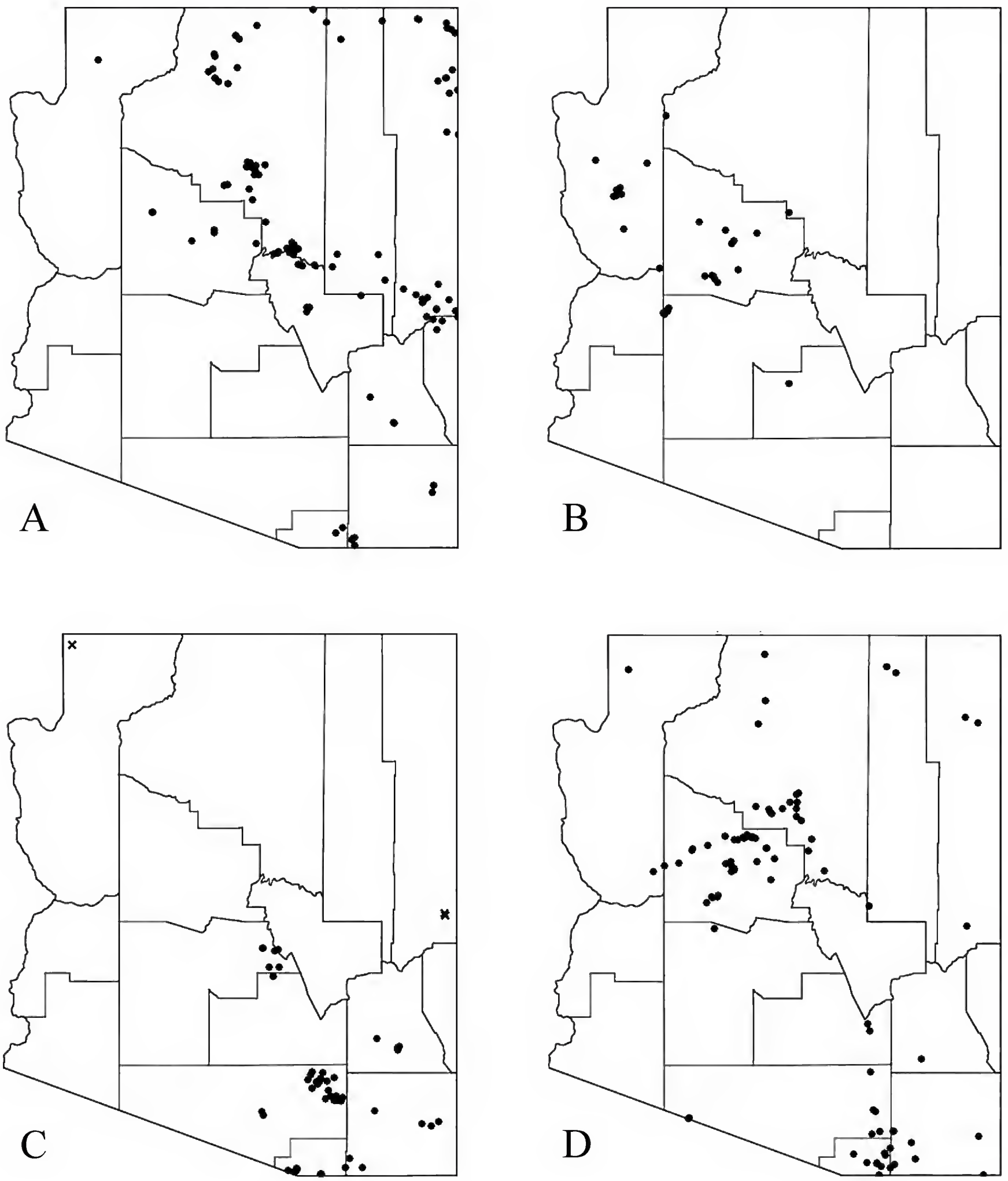
Juncaceae Figure 2. Distribution of: (A) *Juncus acuminatus*; (B) *Juncus acutus* subsp. l*eopoldii*; (C) *Juncus articulatus*; (D) *Juncus balticus* subsp. *ater*



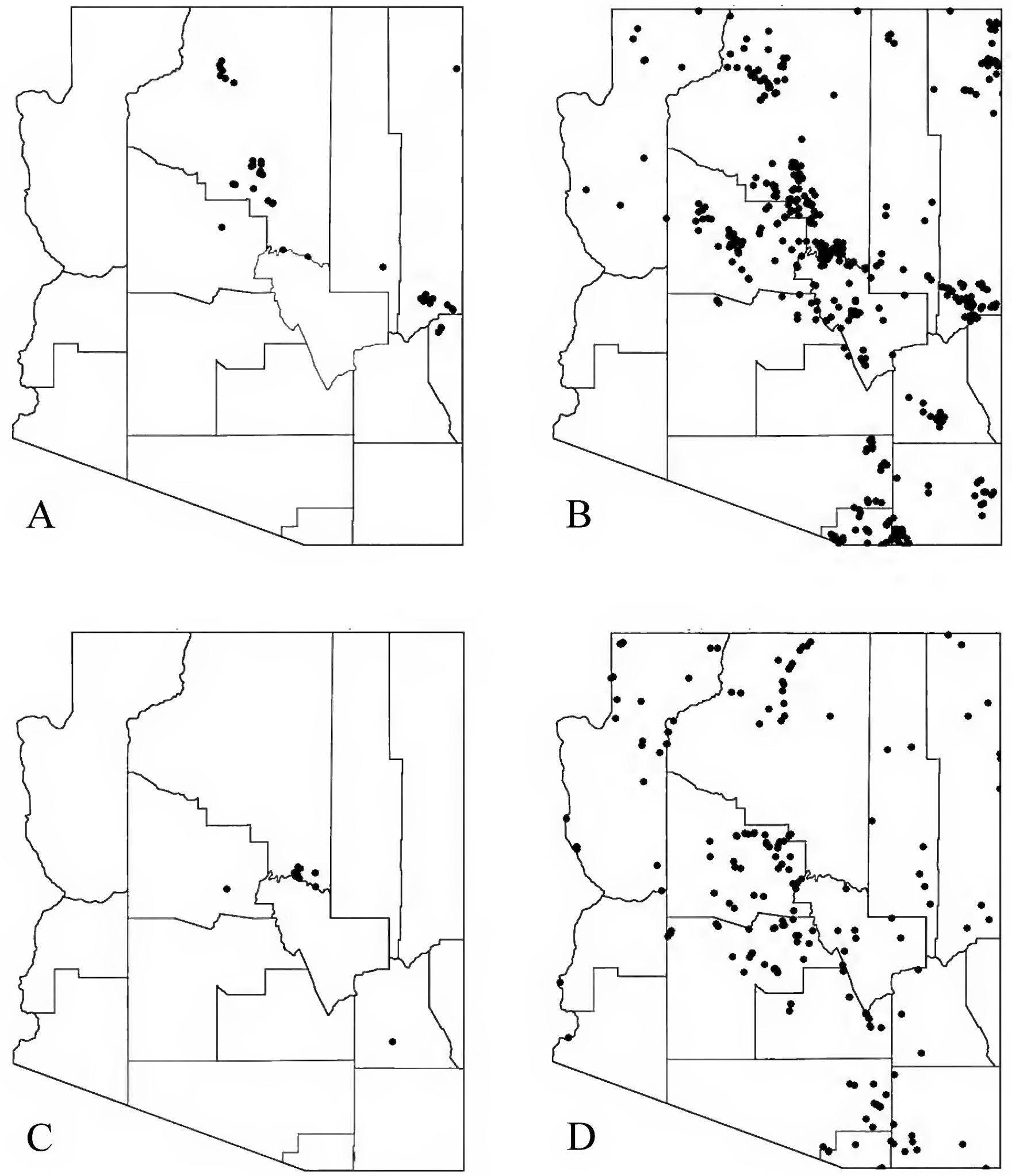
Juncaceae Figure 3. Distribution of: (A) *Juncus brevicaudatus* (x), *Juncus bryoides* (dots); (B) *Juncus bufonius*; (C) *Juncus confusus* (dots), *Juncus cooperi* (x); (D) *Juncus drummondii* (dots), *Juncus dichotomus* (x)



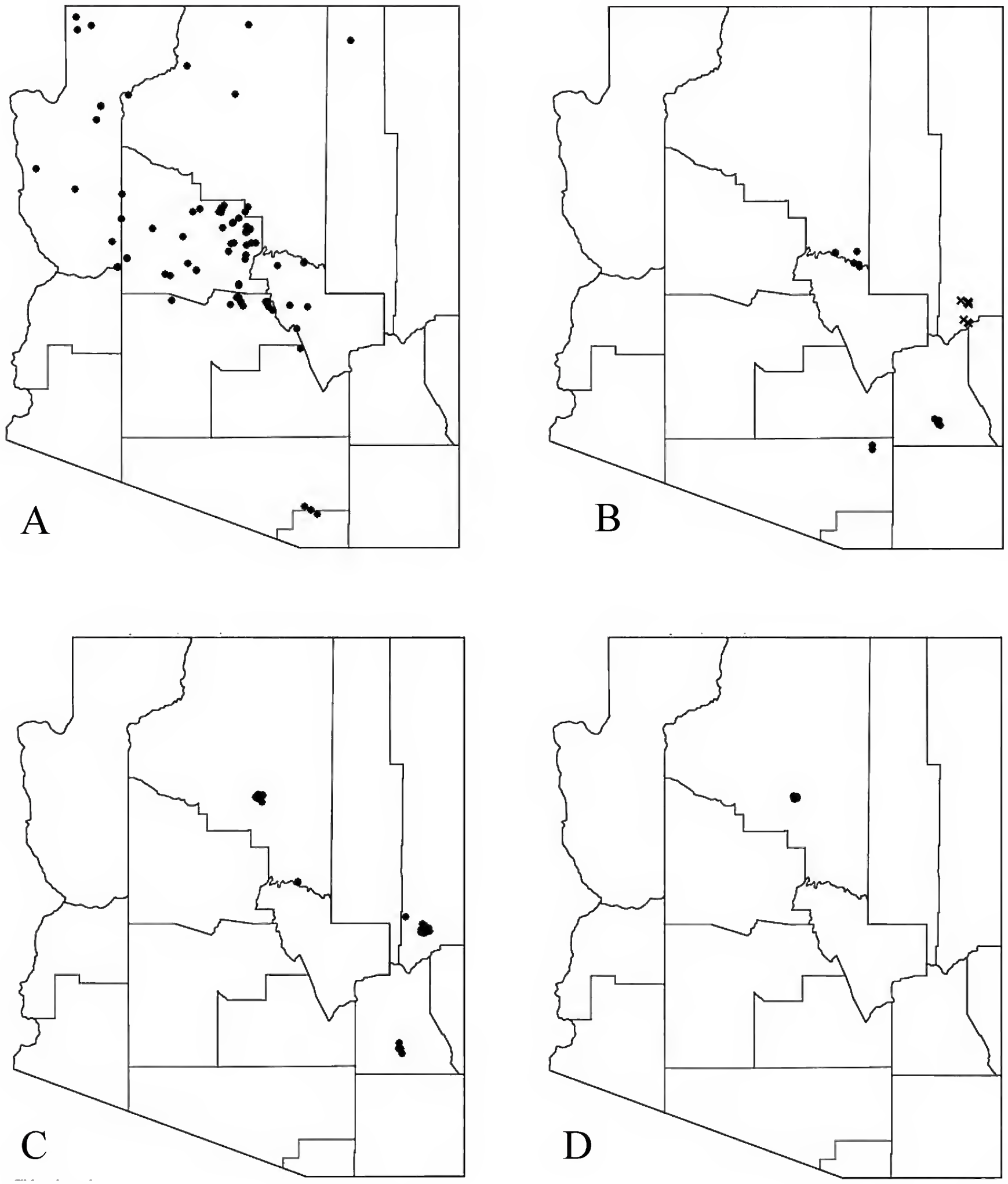
Juncaceae Figure 4. Distribution of: (A) *Juncus dudleyi*; (B) *Juncus effusus* subsp. *austrocalifornicus*; (C) *Juncus exiguus* (x), *Juncus laccatus* (dots); (D) *Juncus interior*



Juncaceae Figure 5. Distribution of: (A) *Juncus longistylis*; (B) *Juncus macrophyllus*; (C) *Juncus marginatus* (dots), *Juncus nodosus* (x); (D) *Juncus mexicanus*



Juncaceae Figure 6. Distribution of: (A) *Juncus nevadensis*; (B) *Juncus saximontanus*; (C) *Juncus tenuis*; (D) *Juncus torreyi*



Juncaceae Figure 7. Distribution of: (A) *Juncus xiphioides*; (B) *Luzula comosa* var. *laxa* (dots), *Luzula multiflora* (x); (C) *Luzula parviflora*; (D) *Luzula spicata*

A Visual Guide to the Rushes (Juncaceae) of Arizona

This is an appendix to the treatment of Juncaceae for the Vascular Plants of Arizona project, which also includes keys, species descriptions, and range maps. It can be used to help verify an identification resulting from use of the treatment, and to appreciate the beauty and diversity of rushes in the genera *Juncus & Luzula* found in Arizona.

Photos by Max Licher unless otherwise noted
Juncus torreyi on the Verde River

Juncus acuminatus - tapertip rush

- Clumping upright habit, from short rhizomes
- Round leaves with crosswalls
- Many hemispherical to ball-like heads
- Heads light brown to greenish
- Mogollon Rim and southern AZ mountains; wetlands

Juncus acutus subsp. ***leopoldii***- spiny rush

- Densely clumping habit, very robust
- Round leaves with very pungent tips, lacking crosswalls
- Flowers individual or in small few-flowered clusters
- Capsule sub-spherical, much longer than tepals
- Western desert; washes with subsurface moisture, springs

Juncus articulatus - jointleaf rush

- Clumping to rhizomatous habit, stems often decumbent
- Round leaves with crosswalls
- Many small few-flowered heads
- Heads light to darker brown
- Capsules exserted from tepals
- Widespread; wetlands

Juncus balticus subsp. ***ater*** - wiregrass

- Rhizomatous habit, from robust thick brown rhizomes
- Leaves reduced to basal sheaths only
- Inflorescences appearing lateral on the stem
- Inflorescence of many individual flowers with bracteoles
- Widespread; seasonally wet sites

Juncus brevicaudatus - narrow-panicled rush

- Clumping upright habit, from short rhizomes
- Round leaves with crosswalls
- Many small few-flowered heads with tapered bases
- Mature heads dark reddish brown
- Capsules exserted from tepals
- Mogollon Rim; wetlands

Juncus bryoides - mosslike dwarf rush

- Tiny annual, clumping from fine fibrous roots
- Threadlike leaves
- Flowers single and terminal
- Infrequent or overlooked; Yavapai County mountains, and Arizona Strip, Mohave County; seasonally wet sandy soils

photo by Chris Wagner

Juncus bufonius - toad rush

- Small annual, clumping from fine fibrous roots
- Threadlike leaves
- Inflorescence elongate, of many single flowers (some paired)
- Whole plant light green
- Widespread; seasonal wetlands, drying pond shores, washes

Juncus confusus - Colorado rush

- Clumping habit, stems in small groups
- Threadlike leaves with long membranous auricles
- Inflorescence congested, of single flowers with bracteoles
- Mature capsule strongly retuse at apex
- Kaibab Plateau, Chuska Mountains, and San Francisco Peaks; mountain meadows

Juncus cooperi - Cooper's rush

- Clumping habit, robust
- Round leaves with pungent tips, lacking crosswalls
- Flowers in small few-flowered clusters
- Capsule ovoid, about as long as tepals
- Only records from Quitobaquito in Organ Pipe Nat. Mon.; otherwise in saline wetlands in CA & NV

Juncus dichotomous - Forked rush

- Coarse, clumping habit
- Narrow, linear leaves
- Inflorescence open, of individual flowers with bracteoles
- Mature capsule obtuse to truncate at end
- One record in the Huachuca Mountains; streambanks

Juncus drummondii - Drummond's rush

- Densely clumping habit
- Leaves reduced to basal sheaths only, lacking crosswalls
- Inflorescence appearing lateral near tip of stem
- Inflorescence a single few-flowered cluster
- San Francisco Peaks; alpine tundra and scree slopes

Juncus dudleyi - Dudley's rush

- Clumping habit
- Threadlike leaves with thick yellowish auricles
- Inflorescence open, of individual flowers with bracteoles
- Mature capsule obtuse to truncate at end
- Widespread; wet to seasonally wet areas

Juncus effusus subsp. ***austrocalifornicus*** - common bog rush

- Clumping habit, robust
- Leaves reduced to basal sheaths only, lacking crosswalls
- Leaf sheath tips asymmetrical, light brown, thin
- Inflorescence appearing lateral on the stem
- Inflorescence of many individual flowers with bracteoles
- Southeast Arizona mountains, and one record from Mogollon Rim; wetlands

Juncus effusus subsp. ***austrocalifornicus*** - common bog rush

- Leaf sheaths illustrated

Juncus exiguus - weak rush

- Clumping habit, robust
- Leaves reduced to basal sheaths only, lacking crosswalls
- Leaf sheath tips symmetrical, thin, with darker edges
- Inflorescence appearing lateral on the culm.
- Inflorescence open, of individual flowers with bracteoles
- Mazatzal and Bradshaw Mountains; wetlands

Juncus exiguus - weak rush

- Leaf sheaths illustrated

Juncus interior - inland rush

- Clumping habit
- Threadlike leaves with thin membraneous auricles
- Inflorescence open, of individual flowers with bracteoles
- Mature capsule obtuse to truncate at end
- Widespread; wet to seasonally wet sites

Juncus laccatus - shiny rush

- Clumping habit, robust
- Leaves reduced to basal sheaths only, lacking crosswalls
- Leaf sheath tips symmetrical, dark brown, thick, glossy
- Inflorescences appearing lateral on the stem
- Inflorescence of many individual flowers with bracteoles
- Mogollon Rim, Sierra Ancha & Pinal Mountains; wetlands

Juncus laccatus - shiny rush

- Leaf sheaths illustrated

Juncus longistylis - longstyle rush

- Rhizomatous habit, stems single or in small groups
- Flat leaves, face towards stem
- Inflorescence of 1-8+ heads on 1-2 main branches
- Heads obconic, with few flowers each,
- Tepals dark brown with green center stripes
- Widespread; moderate to higher elevation wetlands

Juncus macrophyllus - longleaf rush

- Clumping habit, from short rhizomes
- Flat leaves, face towards stem
- Inflorescence of 4-20+ heads on 2-5 main branches
- Heads obconic, with few flowers each,
- Tepals greenish to tan, sometimes with reddish tips
- Western desert mountains to the central highlands; wetlands and washes with subsurface moisture

Juncus marginatus - longleaf rush

- Clumping habit, from short rhizomes
- Flat leaves, face towards stem
- Inflorescence of 10-50+ heads on up to 10 main branches
- Heads obconic, with few flowers each
- Heads greenish to medium brown
- Central to southeast Arizona; wetlands and washes

Juncus mertensianus - Mertens' rush

- Loosely clumping from short rhizomes
- Round leaves with crosswalls
- Inflorescence a single hemispherical to sub-spherical head
- Heads dark brown to blackish
- Not found in Arizona (compare to *Juncus nevadensis*)
- Generally alpine only in other Southwestern states

Juncus mexicanus - Mexican rush

- Rhizomatous habit, from robust thick brown rhizomes
- Single leaf blade on some stems, often compressed, twisted
- Inflorescence appearing lateral on the stem
- Inflorescence of many individual flowers with bracteoles
- Widespread; wet to drying sites

Juncus nevadensis - Sierra rush

- Rhizomatous habit, stems single or in small groups
- Round leaves with crosswalls
- 3-10 hemispheric to obconic heads (typical throughout most of its range in other states, infrequent here - see image below for more common form in Arizona)
- Heads dark brown

Juncus nevadensis - Sierra rush

- 1-2 hemispheric to sub-spheric heads (most common form in Arizona)
- Kaibab Plateau, Chuska & White Mountains, Mogollon Rim; meadows and wetlands

Juncus nodosus - knotted rush

- Rhizomatous habit, stems in small groups or clumps
- Small tubers on the rhizomes
- Round leaves with crosswalls
- 3-15 “spikey” ball-like heads
- Mature capsule subulate, exserted
- Known from two localities: Nutrioso (Apache Co,) and Beaver Dam (Mohave Co.); wetlands, streambanks

Juncus saximontanus - Rocky Mountain rush

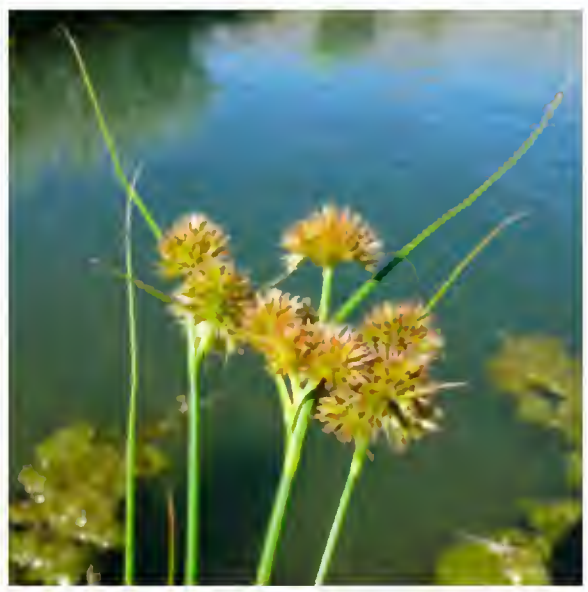
- Rhizomatous habit, stems in small groups or clumps
- Flat leaves with edge towards the stem, like in Iris
- Many small obconic heads of a few flowers each (common phase illustrated at left) - Widespread in Arizona
- Sometimes heads more ball-like and in fewer clusters (see below) - Less common in Arizona

Juncus saximontanus - Rocky Mountain rush

- Phase illustrated with fewer, subspherical, darker heads, with more flowers each
- Wetlands, streambanks, ponds

Juncus tenuis - poverty rush

- Clumping habit
- Threadlike leaves with long, thin, membraneous auricles
- Inflorescence open, of individual flowers with bracteoles
- Mature capsule obtuse to truncate at end
- Infrequent on the Mogollon Rim; wetlands



Juncus torreyi - Torrey's rush

- Rhizomatous habit, stems in small groups or clumps
- Tuberous segments on the rhizomes
- Round leaves with crosswalls
- Several large ball-like heads
- Mature capsule subulate, about as long as tepals
- Widespread; wetlands

Juncus xiphioides - irisleaf rush

- Rhizomatous habit, stems in small groups or clumps
- Flat leaves with edge towards the stem, like in Iris
- Many small heads of a few flowers each
- Much more robust than *J. saximontanus,* with wider leaves
- Grand Canyon, and western to central AZ; lower to mid-elevation wetlands

Luzula comosa var. *laxa*
- pacific woodrush

- Clumping habit, from short rhizomes, bases sometimes bulbous
- Flat leaves, with hairs along the lower edges, sheath closed
- Inflorescence upright, of heads on pedicels of varying lengths
- 10-40 cm tall ; tepals pale brown
- Mogollon Rim, Catalina, Pinaleno, & Rincon mountains; wet meadows, streambanks

Luzula multiflora subsp. *multiflora*
- common woodrush

- Clumping habit, from short rhizomes, bases not bulbous
- Flat leaves, with hairs along the lower edges, sheath closed
- Inflorescence upright, of heads on pedicels of varying lengths
- 10-40 cm tall; tepals rich, deep brown
- White Mountains; wet meadows, streambanks

Luzula parviflora
- smallflowered woodrush

- Clumping habit, from short rhizomes
- Flat leaves, with hairs along the lower edges, sheath closed
- Inflorescence nodding, of many single flowers or small clusters
- 30-100 cm tall, capsules equal to longer than tepals
- San Francisco Peaks, White Mountains, Pinalenos, and Mogollon Rim; meadows and forest edges

Luzula spicata subsp. *spicata*
- spiked woodrush

- Clumping habit, from short rhizomes,
- Flat leaves, with hairs along the lower edges, sheath closed
- Inflorescence nodding, spikelike, of several adjacent clusters
- 3-30 cm tall
- Capsules shorter than tepals
- San Francisco Peaks; alpine tundra and scree slopes

FLORA OF CANADA DEL ORO WASH, PIMA COUNTY, ARIZONA

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ABSTRACT: This study establishes a baseline flora for the Pima County Regional Flood Control District's natural resource park, *The Oasis*, along the Canada del Oro wash. The study site is an ephemeral wash lined with Sonoran Deciduous Riparian Scrub and Sonoran Interior vegetation types, including about 220 acres. In total, 153 taxa in 38 families were identified between September 2015 and September 2017. Plant families with the largest presence include Asteraceae (28 taxa), Poaceae (26 taxa), Boraginaceae (13 Taxa), and Fabaceae (11 Taxa).

THE STUDY AREA

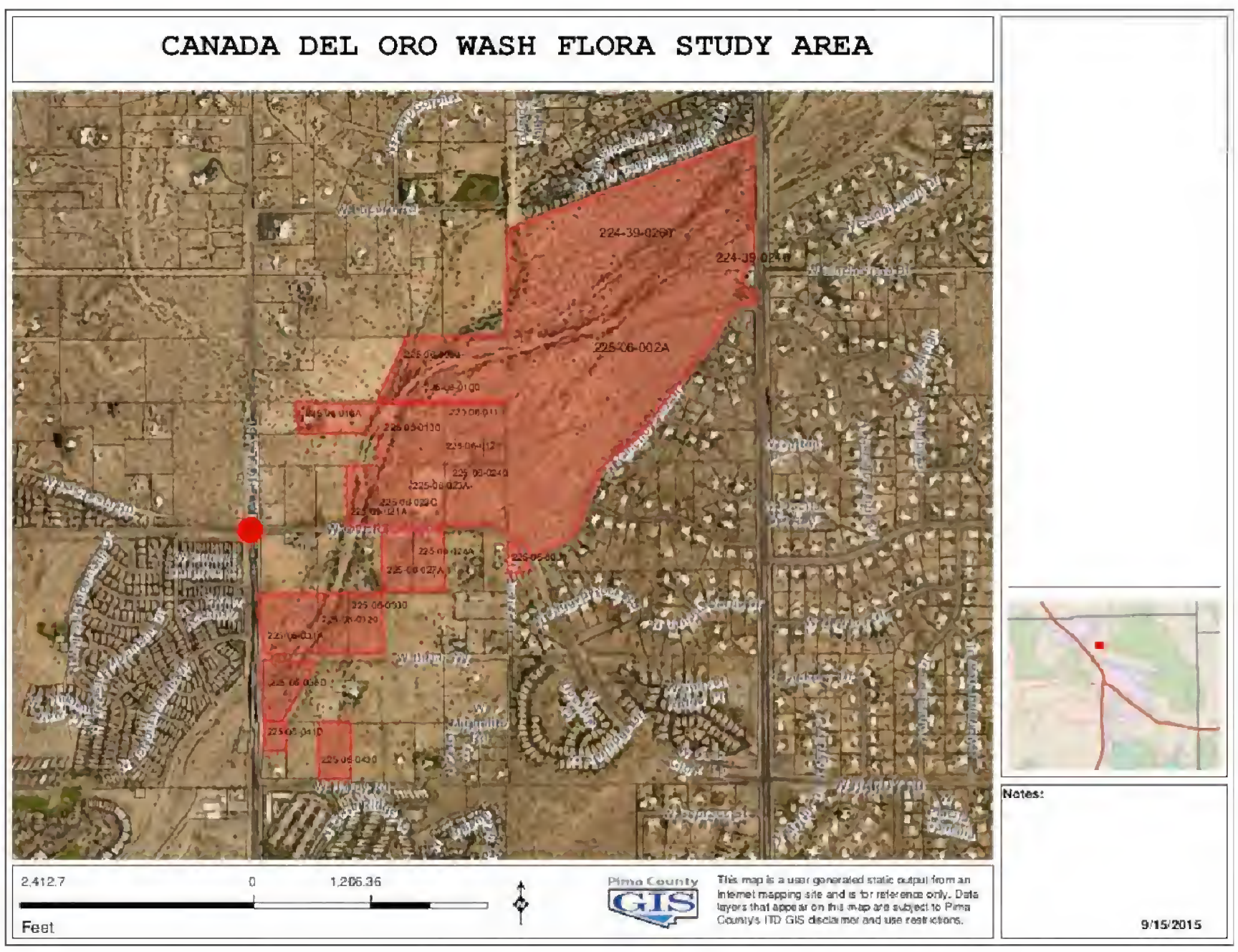

Figure 1. Map of study area. Red shading indicates study area. Red dot indicates corner of N La Cholla Blvd. and W Overton Rd.

Location: The study area, *The Oasis*, on the Canada del Oro (CDO) wash and adjacent mesquite woodlands (bosques) (Fig. 1), includes elevations varying between 705 –755 meters

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as measured by GPS (+/- 5 meters), the low point being under the La Cholla Bridge near the southwest corner and the high point being just east of the La Canada water tank near the northeast corner. The center point is approximately at 32° 22' 43" North and 111°00' 21.65" West.

Site History: The study area consists of 22 parcels acquired by the District between 1984 and 2014. Eight of the parcels originally contained structures that have since been removed. Foundations of various structures can be seen when visiting the study area. Recently, the District fenced the site in an effort to restrict off-road vehicles. Despite the fencing, evidence of off-road vehicle traffic is still present within the study area due to access where Overton Road crosses the CDO wash. A paved path runs the length of the study area from the Northeast corner to the Southwest corner. The area is used for bicycling, horseback riding and hiking.

Substrate and Geology: The entire area consists of Pleistocene/Holocene sand and gravel deposits along the CDO wash (and tributaries) and immediately above it. The sand and gravel consist of a mixture of Catalina Gneiss and Catalina Granite (Chronic 1983). The soil along the major washes (CDO and major tributaries) consists of the Arizo-Riverwash Complex and the higher ground consists of Anthony fine sandy loam. There is also a small area in the northeast corner where the surface consists of very cobbly sandy soil of the Pinaleno-Stagecoach-Palos Verdes complex (Soil Survey Staff, 2018).

Climate: The climate in Oro Valley consists of two relatively wet periods, December to March and late June to mid-September, with very dry periods in between. The December to March wet period is due to moist air flowing in from the Pacific. The rain during this period is gentle and usually widespread. The June to mid-September wet period is due to tropical air flowing in from the south and is characterized by violent thunderstorms and localized torrential rain fall. Occasionally the period of September to November can experience a tropical depression from the Sea of Cortez which will cause significant rain fall. The temperatures from late April to October normally range from 35–40° C during the day although occasionally they can reach 45° C. From November to mid-April, temperatures during the day are normally quite mild with an occasional freeze at night (Phillips et al. 2000).

Vegetation: There are two biotic communities in the study area: Sonoran Interior Strands and Sonoran Deciduous Riparian Scrub, described in the Pima County *Sonoran Desert Conservation Plan* (Harris et al. 2000). Both of these biotic communities consist of riparian vegetation. On the lower ground, *Baccharis sarothroides* is conspicuous along with *Chilopsis linearis* and various *Ambrosia* species, especially *A. monogyra*. These are in addition to many herbs and grasses that grow in the low, locally wetter, locations. On the higher ground, the dominant trees are *Prosopis velutina* and *Parkinsonia florida*. The dominant shrubs are *Larrea tridentata* and two *Gutierrezia* species. On the rockier soils, *Senna covesii* and *Encelia farinosa* are conspicuous, but are not found in the Anthony fine sandy loam. In addition, there are several locations where cacti are locally common including *Ferocactus wislizeni*, and the various *Opuntia* spp. and *Cylindropuntia* spp. *Carnegiea gigantea* only occurs in a few locations with one obviously very old individual and several young plants.

The largest families are the Asteraceae with 28 species and Poaceae with 26 species followed by the Boraginaceae with 13 species, Fabaceae with 11 species, Brassicaceae and the Cactaceae both with 7 species and finally the Amaranthaceae and the Malvaceae with 5 species each. This distribution of families is as expected in this area.

Twenty-eight of the 153 species found, or 18%, are non-native. This relatively high percentage of non-natives is a reflection of the disturbed nature of the study area. Disturbances include natural periodic flooding and human caused disturbances such as old homesteads and off-road vehicles.

Not surprisingly, annuals account for 82 species or over half the total. Shrubs or subshrubs are next with 33 species (one *Yucca* and one *Agave* are considered shrubs). Perennial herbs number 25, two of which are climbers (*Funastrum cynanchoides* and *Clematis drummondii).* There are 7 cacti ranging from one small species (*Echinocereus fendleri)* to the tree-like *Carnegiea gigantea.* Finally, there are 6 species of trees.

The lack of small cacti is surprising. Only one individual of one species (*Echinocereus fendleri)* was found in the study area. I believe that reflects the relative instability of the substrate, which is mostly sand, and of the periodic flooding. Annuals, that can come and go quickly, or trees or shrubs, that are large enough to resist flooding, seem to do better in this unstable environment. Interestingly *Echinocereus fendleri* was found in the small area of relatively rocky more stable soil in the extreme northeast corner of the study area.

The perennials and subshrubs tend to be: 1) plants with short life cycles (e.g., *Baileya multiradiata*); 2) strong and deep-rooted subshrubs (e.g., *Ambrosia salsola*); plants found only near the wash edges on higher more stable ground (e.g., *Penstemon parryi*); climbers anchored to strong trees or fences (e.g., *Clematis drummondii*); or rare species (e.g., *Cucurbita digitata*). There are however a few exceptions, like *Ambrosia confertiflora,* which seem to do quite well in the unstable environments.

METHODS

Taxonomic scope–Collections were limited to vascular plants. Specimens in the Poaceae were identified using *Grasses of the Southwestern United States* (Gould 1993) and Flora of North America vol. 24 and 25 (Flora of North America editorial committee 2003 and 2007). The genus *Cryptantha* was identified using the San Diego State University web page *Cryptantha s.s. Taxonomy & Images* (Simpson 2018). The remaining plants were identified using the *Flora of North America* (Flora of North America editorial committee 2003+) and the *Arizona Flora* (Kearney et al. 1960). Any doubtful identifications were resolved by comparing the unknown plants to herbarium sheets at the University of Arizona Herbarium. Accepted names and synonyms follow The Plant List (The Plant List 2013).

There were 63 individual collecting trips over two years from September 2015 to September 2017. One of the trips was with Ries Lindley and Brian Gersten. The rest of the trips were on my own. Each specimen was photographed several times before being collected. The photographs are in SEINet attached to my SEINet collecting records (SEINet Portal Network, 2018). Plants were only collected from land owned by the District (Figure 1). The collected material was processed (pressed and dried) using standard procedures and equipment. The University of Arizona was the first depository of the vouchers, with the Desert Botanical Gardens and Arizona State University as secondary locations.

Herbarium search–SEINet was searched for specimens collected in the study area prior to this study, but none were found. (SEINet Portal Network, 2018)

Catalog of the Vascular Plants of the Canada del Oro Wash

All collections (indicated by collection numbers) were made by the author.
Names preceded by an asterix (*) indicate introduced species.

ACANTHACEAE
Justicia californica (Benth.) D. Gibson. Beloperone. Shrub. *171*

AIZOACEAE
Trianthema portulacastrum L. Desert Horsepurslane. Annual Herb. *136*

AMARANTHACEAE
Amaranthus fimbriatus (Torr.) Benth. ex S. Wats. Fringed Amaranth. Annual herb. *3*
Amaranthus palmeri S. Wats. Carelessweed. Annual herb. *117.*
Atriplex canescens (Pursh) Nutt. Four-wing Saltbush. Perennial shrub. *28, 127, 128*
Chenopodium incanum (S. Wats.) Heller. Mealy Goosefoot. Annual herb. *107*
*Tidestromia suffruticosa (*Torr.) Standl**.** Shrubby Honeysweet. Perennial subshurb. *19*

APOCYNACEAE–DOGBANE FAMILY
Sarcostemma cynanchoides subsp. *hartwegii* (Vail) R. W. Holm. [*Funastrum cynanchoides (Decne.)* Schltr.]. Fringed Twinevine. Perennial herb. Twining vine. *111*

ARECACEAE–PALM FAMILY
**Washingtonia robusta* H. Wendl. Washington Fan Palm. Tree. Two individuals occurred next to some old foundations. *30*

ASPARAGACEAE–ASPARAGUS FAMILY
**Agave* cf. *univittata* Haw. [*Agave heteracantha* Zucc] McKelvey's century plant. Shrub. Garden escape. *130*
Dichelostemma capitatum (Benth.) Alph. Wood. [*Dipterostemon capitatus* (Benth.) Rydb.] Bluedicks. Perennial herb. *185*
Yucca elata (Engelm.) Engelm. Soaptree Yucca. Shrub. Native to the region, but this was probably planted. *197*

ASTERACEAE–ASTER FAMILY
Ambrosia ambrosioides (Cav.) W. W. Payne. [*Franseria ambrosioides* Cav.]. Ambrosia Leaf Bur Ragweed. Shrub. *91*
Ambrosia confertiflora DC. [*Franseria confertiflora* (DC.) Rydb.]. Weakleaf Bur Ragweed. Perennial herb. *18, 144*
Ambrosia deltoidea (Torr.) W. W. Payne. [*Franseria deltoidea* Torr.]. Triangle Bur Ragweed. Shrub. *180*
Ambrosia monogyra (Torr. & A. Gray) Strother & B. G. Baldwin. [*Hymenoclea monogyra* Torr. & A. Gray.]. Singlewhorl Burrobush. Shrub. *163, 36, 108, 157*
Baccharis salicina Torr. & A. Gray [*Baccharis salicifolia* (Ruiz & Pav.) Pers.]. Mule-fat. Shrub. *151*
*Ambrosia salsola (*Torr. & A. Gray) Strother & B. G. Baldwin. [*Hymenoclea salsola* Torr. & A. Gray ex Torr. & A. Gray]. Burrobrush. Perennial/subshrub. *88*
Baccharis sarothroides A. Gray. Desertbroom. Shrub. *31*
Baileya multiradiata Harv. & A. Gray ex Torr. [*Baileya australis* Rydb.] Desert Marigold. Annual/perennial herb. *23, 131*
**Centaurea melitensis* L. Maltese Star-Thistle. Annual/biennial herb. *193*
Encelia farinosa A. Gray ex Torr. Brittlebush. Shrub. *39*
Encelia frutescens (A. Gray) A. Gray. Button Brittlebush. Shrub. *129, 187*
Erigeron neomexicanus A. Gray. [*Achaetogeron sophiaefolius* Larsen] New Mexico Fleabane. Perennial herb. *79*
Filago depressa A. Gray. Dwarf Cottonrose. Annual herb. *176*
Gutierrezia microcephala (DC.) [*Brachyris microcephala* DC.] Threadleaf Snakeweed. Perennial/subshrub. *181*
Gutierrezia serotina Greene. [*Gutierrezia polyantha* A.Nels.] Late Snakeweed. Shrub. *106*

Heterotheca subaxillaris (Lam.) Britton & Rusby. [*Chrysopsis scabra* (Pursh) Ell.] Camphorweed. Annual/perennial herb. *15*
Hymenothrix wislizeni A. Gray. Trans-Pecos Thimblehead Annual/biennial herb. *38*
Isocoma tenuisecta Greene. [*Haplopappus acradenius* (Greene) S. F .Blake]. Burroweed. Perennial/subshrub. *16*
**Lactuca serriola* L. [*Lactuca scariola* L.] Prickly Lettuce. Annual/biennial herb. *114*
Machaeranthera asteroides (Torr.) Greene [*Machaeranthera asteroides* var. *glandulosa* B. L. Turner.][*Dieteria asteroides* Torr.] Fall Tansyaster. Biennial/perennial herb. *26*
Machaeranthera pinnatifida var *gooddingii* (A. Nelson) B. L. Turner [*Xanthisma spinulosum* (Pursh) D. R. Morgan & R. L. Hartm.]. Lacy Tansyaster. Perennial/subshrub. *29, 96*
Machaeranthera tagetina Greene. [*Aster tagetinus* (Greene) S. F. Blake]. Mesa Tansyaster. Annual herb. *37*
**Oncosiphon piluliferum* (L. f.) Kallersjo. [*Matricaria globifera* (Thunb.) Frenzl ex Harv.]. Stinknet. Annual herb. *189*
Pectis papposa Harv. & A. Gray. Manybristle Chinchweed. Annual herb. *14*
**Sonchus oleraceus* (L.) L. Common Sowthistle. Annual herb. *83*
Verbesina encelioides (Cav.) Benth. & Hook.f. ex A. Gray. [*Verbesina scabra* Benth.] Golden Crownbeard. Annual herb. *112, 169*
Xanthium strumarium L. [*Xanthium acerosum* Greene] Rough Cockelebur. Annual herb. *145*
Zinnia acerosa (DC.) A. Gray. Desert Zinnia. Perennial/subshrub. *27*

BIGNONIACEAE–BIGNONIA FAMILY
Chilopsis linearis (Cav.) Sweet. Desert Willow. Tree. *100*

BORAGINACEAE–FORGET-ME-NOT FAMILY
Amsinckia menziesii (Lehm.) A. Nelson & J. F. Macbr. [*Amsinckia hispidissima* Suksd.] Menzie's Fiddleneck. Annual herb. *43*
Amsinckia menziesii var *intermedia* (Fisch. & C. A. Mey.) [*Amsinckia arizonica* Suksdorf] Common Fiddleneck. Annual herb. *78, 178*
Cryptantha micrantha (Torr.) I. M. Johnst. [*Eremocarya lepida* (A. Gray) Greene] Redroot Cryptantha. Annual herb. *191*
Cryptantha barbigera (A. Gray) Greene. [*Eritrichium barbigerum* A. Gray] Bearded cryptantha. Annual herb. *179*
Cryptantha pterocarya (Torr.) Greene. Wingnut Cryptantha. Annual herb. *73,182*
Cryptantha angustifolia (Torr.) Greene. [*Johnstonella angustifolia* (Torr.) Hasenstab & M.G.Simpson.] Panamint Cryptantha. Annual herb. *81*
Eucrypta micrantha (Torr.) A. Heller. [*Ellisia micrantha* (Torr.) Brand] Dainty Desert Hide-seed. Annual herb. *183*
Lappula occidentalis (S. Watson) Greene. [*Lappula redowskii* subsp. *occidentalis* (S. Watson) A. Löve & D. Löve] Flatspine Stickseed. Annual herb. *52, 56*
Nama hispida A. Gray. [*Nama foliosum* (Woot. & Standl.) Tidestr.] Bristly Nama. Annual herb. *21, 90*
Pectocarya platycarpa (Munz & I. M. Johnst) Munz & I. M. Johnst. [*Pectocarya gracilis* var. *platycarpa* Munz & Johnston] Broadfruit Combseed. Annual herb. *47, 59*
Phacelia campanularia A. Gray. Desertbells. Annual herb. *71*
Phacelia crenulata Torr. ex S. Watson. Cleftleaf wildheliotrope. Annual herb. *70*
Plagiobothrys arizonicus (A. Gray) Greene ex A. Gray. Arizona Popcorn-flower. Annual herb. *58*

BRASSICACEAE–MUSTARD FAMILY
**Capsella bursa-pastoris* (L.) Medik. [*Bursa bursa-pastoris* (L.) Britton] Shepherd's Purse. Annual herb. *65*
**Chorispora tenella* (Pall.) DC. Cross Flower. Annual herb. *63*
Draba cuneifolia var *integrifoia* S. Watson. California Draba. Annual herb. *60*
Lepidium oblongum Small. Veiny Pepper-weed. Annual/biennial herb. *46*
Physaria gordonii (A. Gray) O'Kane & Al-Shehbaz. [*Lesquerella gordonii* (A. Gray) S. Watson]. Gordon's Bladderpod. Annual herb. *53*
**Sisymbrium altissimum* L. [*Norta altissima* (L.) Britt.] Tall Tumblemustard. Annual/biennial herb. *49*

**Sisymbrium irio* L. [*Norta irio* (L.) Britt.] London Rocket. Annual herb. *42*

CACTACEAE–CACTUS FAMILY
Carnegiea gigantea (Engelm.) Britton & Rose. [*Cereus giganteus* Engelm.]. Saguaro. Tree. *103*
Cylindropuntia fulgida (Engelm.) F. M. Knuth. [*Opuntia fulgida* Engelm.] Jumping Cholla. Shrub. *101*
Cylindropuntia versicolor (Engelm. ex Toumey) F. M. Knuth [*Cylindropuntia thurberi* subsp. *versicolor*]. Staghorn Cholla. Shrub. *99*
Echinocereus engelmannii subsp. *fendleri* (Engelm. ex S. Watson) Blum, Lange, & Rutow. Pink Flower Hedgehog Cactus. Small perennial succulent. *190*
Ferocactus wislizeni (Engelm.) Britton & Rose [*Echinocactus wislizeni* Engelm.] Candy Barrelcactus. Shrub. *199*
Opuntia engelmannii Salm-Dyck ex Engelm. [*Opuntia subarmata* Griffiths] Cactus Apple. Shrub. *194*
Opuntia santarita (Griffiths & Hare) J. N. Rose [*Opuntia santa-rita* (Griffiths & Hare) Rose] Santa Rita Pricklypear. Shrub. *105*

CANNABACEAE–CANNABIS FAMILY
Celtis pallida Torr. [*Celtis ehrenbergiana* (Klotzsch) Liebm.]. Spiny Hackberry. Shrub. *122*

CLEOMACEAE–BEEPLANT FAMILY
Polanisia dodecandra (L.) Dc. [*P. trachysperma* Torr. & A. Gray]. Redwhisker Clammyweed. Annual herb. *109*

CONVOLVULACEAE–MORNING GLORY FAMILY
Ipomoea barbatisepala A. Gray. Canyon Morning-Glory. Annual herb. *153*
**Ipomoea nil* (L.) Roth [*Ipomoea hederacea* (L.) Jacq.] Ivyleaf Morning-Glory. Annual herb. *150*
Ipomoea ternifolia Cav. Tripleleaf Morning-Glory. Annual herb. *149, 152*

CRASSULACEAE–STONECROP FAMILY
Crassula connata (Ruiz & Pav.) A. Berger. [*Tillaea erecta* Hook. & Arn.]. Sand Pygmy-weed. Annual herb. *177*

CUCURBITACEAE–GOURD FAMILY
Cucurbita digitata A. Gray. Fingerleaf Gourd. Perennial herb. *54*

CYPERACEAE–SEDGE FAMILY
Cyperus eragrostis Lam. [*Cyperus vegetus* Willd.] Tall Flatsedge. Perennial herb. Maybe no longer in existence. This was seen in a temporary wetland formed by the water output of an air-conditioner. Later the wetland disappeared. *115*

EPHEDRACEAE–MORMON TEA FAMILY
Ephedra trifurca Torr. ex S. Watson longleaf jointfir. Shrub. *45*

EUPHORBIACEAE–SPURGE FAMILY
Croton californicus Mull. Arg. California croton. Perennial herb/subshrub. *125*
Euphorbia hyssopifolia L. [*Chamaesyce hyssopifolia* (L.) Small]. Hyssopleaf Sandmat. Annual/perennial herb. *118, 119*
Euphorbia micromera Boiss. ex Engelm. [*Chamaesyce micromera* (Boiss. ex Engelm.) Wooton & Standl.]. Sonoran Sandmat. Annual herb. *117*

FABACEAE–PEA FAMILY
Acacia constricta A. Gray [*Vachellia constricta* (Benth.) Seigler & Ebinger.] Whitethorn Acacia. Shrub to small tree. *40*
Acacia greggii A. Gray [*Senegalia greggii* (A. Gray) Britton and Rose.] Catclaw Acacia. Shrub. *102*

Acmispon oroboides (Kunth) Brouillet. [*Lotus oroboides* (Kunth) Ottley] New Mexico Bird's-Foot Trefoil. Perennial herb. *69*
Astragalus lentiginosus Hook. Freckled Milkvetch. Annual/perennial/subshrub. *55*
Lupinus concinnus J. Agardh. Bajada Lupine. Annual herb. *85*
Lupinus sparsiflorus Benth. [*L. sparsiflorus* subsp. *Mohavensis* Dziekanowski & D. B. Dunn. SLW]. Coulter's Lupine. Annual herb. *61*
**Melilotus indicus* (L.) All. [*Melilotus indica* (L.) All.] Annual Yellow Sweetclover. Annual herb. *80*
Olneya tesota A. Gray. Desert Ironwood. Tree. *104*
Parkinsonia florida (A. Gray) S. Watson [*Cercidium floridum* Benth. ex A. Gray]. Palo Verde. Tree. *92*
Prosopis velutina Wooton [*P. juliflora* var. *velutina* (Wooton) Sarg.]. Velvet Mesquite. Tree. *8*
Senna covesii (A. Gray) H. S. Irwin & Barneby. [*Cassia covesii* A. Gray]. Coues' Cassia. Shrub. *121*

GERANIACEAE–GERANIUM FAMILY
**Erodium cicutarium* (L.) L'Hér. [*Geranium cicutarium* L.] Red-stem Stork's Bill. Annual/biennial herb. *44*

LAMIACEAE–MINT FAMILY
Salvia columbariae Benth. Chia. Annual herb. *87*

LOASACEAE–LOASA FAMILY
Mentzelia multiflora (Nutt.) A. Gray. Adonis Blazingstar. Biennial/perennial herb. *98*
Petalonyx thurberi A. Gray. Thurber's Sandpaper Plant. Shrub. *123*

MALVACEAE–MALLOW FAMILY
Thespesia lampas (Cav.) Dalzell [*Gossypium thurberi* Tod.] Thurber's Cotton. Shrub. *133*
**Malva parviflora* L. Cheeseweed Mallow. Annual/perennial herb. *172*
Sphaeralcea ambigua subsp. *rosacea* (Munz &I. M. Johnst.) Kearney. Rose Globemallow. Shrub. *95*
Sphaeralcea coulteri (S. Watson) A. Gray. Coulter's Globemallow. Annual herb. *192*
Sphaeralcea emoryi Torr. ex A. Gray. Emory's Globemallow. Perennial subshrub. *94*

MARTYNIACEAE–UNICORN PLANT FAMILY
Proboscidea althaeifolia (Benth.) Decne. [*Martynia althaeifolia* Benth.] Desert Unicorn-Plant. Perennial herb. *25*
Proboscidea parviflora (Wooton) Wooton & Standl. [*Martynia parviflora* Wooton] Doubleclaw. Annual herb. *134*

MOLLUGINACEAE–CARPETWEED FAMILY
Mollugo verticillata L. [*Mollugo berterana* Ser.] Green Carpetweed. Annual herb. *6*

NYCTAGINACEAE–FOUR-O'CLOCK FAMILY
Allionia incarnata L. [*Allionia craterimorpha* Rusby] Trailing Windmills. Annual/perennial herb. *7, 24*
Boerhavia coulteri (Hook. f.) S. Watson [*B. spicata* var. *palmeri* S. Watson]. Coulter's Spiderling. Annual/perennial herb. *142*

ONAGRACEAE–EVENING PRIMROSE FAMILY
Eulobus californicus Nutt. [*Camissonia californica* (Nutt.) P. H. Raven. *Oenothera leptocarpa* Greene]. California Suncup. Annual/perennial herb. *84, 93*
Oenothera primiveris A. Gray. Desert Evening Primrose. Annual herb. *57*

PAPAVERACEAE–POPPY FAMILY
Argemone pleiacantha Greene. Southwestern Pricklypoppy. Perennial herb. *89*
Eschscholzia californica subsp. *mexicana* (Greene) C. Clark. California Poppy. Annual herb. *68*

PLANTAGINACEAE–PLANTAIN FAMILY

Nuttallanthus texanus (Scheele) D.A.Sutton. [*Linaria canadensis* var. *texana* (Scheele) Pennell] Texas Toadflax. Annual/biennial herb. *184*
Penstemon parryi (A. Gray) A. Gray. [*Penstemon puniceus* var. *parryi* A. Gray] Parry's Penstemon. Perennial herb. *75*
Plantago patagonica Jacq. [*P. purshii* Roem. & Schult.]. Largebracted Plantain. Annual/perennial herb. *76*
Veronica anagallis-aquatica L. Water speedwell. Biennial/perennial herb. Maybe no longer in existence within the study area. Found next to an outlet of an air conditioner that was leaking in a small wetland. *116*

POACEAE–GRASS FAMILY
Aristida purpurea Nutt. Purple Threeawn. Annual/perennial. *195*
Bouteloua aristidoides (Kunth) Griseb. [*Aristida unilateralis* Willd. ex Steud.] Needle Grama. Annual. *13*
Chondrosum barbatum (Lag.) Clayton [*Bouteloua barbata* Lag.] Sixweeks grama. Annual. *196*
Bromus arizonicus (Shear) Stebbins. [*Ceratochloa arizonica* (Shear) Holub] Arizona Brome. Annual. *187*
**Bromus rubens* L. [*Anisantha rubens* (L.) Nevski] Red Brome. Annual. *51, 64*
**Cenchrus ciliaris* L. [*Pennisetum ciliare* (L.) Link] Buffelgrass. Perennial. *41, 173*
**Pennisetum setaceum* (Forssk.) Chiov. [*Cenchrus setaceaus* (Forssk.) Morrone.] Fountain grass. Perennial. *174*
Chloris virgata Sw. [*Chloris alba* J.Presl] Feather Fingergrass. Annual. *35, 113*
**Echinochloa colona* (L.) Link. Jungle rice. Annual. *110*
Eragrostis barrelieri Daveau. [*Eragrostis poaeoides* var. *barrelieri* (Daveau) Fiori] Mediterranean lovegrass. Annual. *168*
**Enneapogon cenchroides* (Licht. Ex Roem. & Schult.) C. E. Hubb. [*Enneapogon mollis* Lehm.] Soft Feather Pappusgrass. Annual/perennial. *86, 139, 141, 154, 138*
**Eragrostis cilianensis* (All.) Janch. [*Briza eragrostis* L.] Stinkgrass. Annual. *12, 147, 165*
**Eragrostis curvula* (Schrad.) Nees. [*Eragrostis chloromelas* Steud.] Weeping lovegrass. Perennial. *22, 74, 156*
**Eragrostis lehmanniana* Nees. Lehmann Lovegrass. Perennial. *143, 167*
Eriochloa aristata Vasey. [*Eriochloa punctata* var. *aristata* (Vasey) M. E. Jones] Bearded cupgrass. Annual. *155, 166*
Eragrostis mexicana (Hornem.) Link. Mexican lovegrass. Annual. *160*
**Hordeum murinum* L. Mouse barley. Annual. *62, 66*
**Leptochloa panicea* (Retz.) Ohwi. Mucronate Sprangletop. Annual/perennial. *146*
**Melinis repens* (Willd.) Zizka. [*Erianthus repens* (Willd.) P. Beauv.] Rose natalgrass. Annual/Perennial. *34*
Muhlenbergia microsperma (DC.) Trin. [*Agrostis microcarpa* Steud.] Littleseed muhly. Annual. *158, 175*
**Schismus barbatus* (L.) Thell. [*Electra brevifolia* Nees ex Steud.] Common Mediterranean Grass. Annual.
Setaria leucopila (Scribn. & Merr.) K. Schum. [*Chaetochloa leucopila* Scribn. & Merr.] Streambed bristlegrass. Perennial. *132*
Sporobolus contractus Hitchc. [*Sporobolus cryptandrus* var. *strictus* Scribn.] Spike Dropseed. Perennial. *120, 159, 198*
Sporobolus cryptandrus (Torr.) A. Gray. [*Agrostis cryptandra* Torr.] Spike Dropseed. Perennial. *135*
Sporobolus wrightii Scribn. [*Epicampes crassiculmis* Piper] Big sacaton. Perennial. *138*
Urochloa arizonica (Scribn. & Merr.) Morrone & F.Zuloaga. [*Panicum arizonicum* Scribn. & Merr.]. Arizona Signalgrass. Annual. *11*

POLEMONIACEAE–PHLOX FAMILY
Eriastrum diffusum (A. Gray) H. Mason. Miniature Woollystar. Annual herb. *82*

POLYGONACEAE–KNOTWEED FAMILY
Eriogonum deflexum Torr. Flatcrown Buckwheat. Annual herb. *97*
Eriogonum wrightii Torr. ex Benth. [*Eriogonum helianthemifolium* Benth.] Bastardsage. Perennial herb. *164*
Rumex hymenosepalus Torr. Canaigre Dock. Perennial herb. *67*

RANUNCULACEAE–BUTTERCUP FAMILY
Clematis drummondii Torr. & A. Gray. Drummond's Clematis. Perennial twining climber (vine). *32*

SANTALACEAE–SANDALWOOD FAMILY
Phoradendron californicum Nutt. Mesquite Mistletoe. Perennial/subshrub. *77*

SOLANACEAE–NIGHTSHADE FAMILY
Datura discolor Bernh. Desert Thorn-Apple. Annual herb. *10, 186*
Lycium andersonii A. Gray. Anderson Wolfberry. Shrub. *148*
**Nicotiana glauca* Graham. [*Siphaulax glabra* Raf.] Tree Tobacco. Shrub. *33*
Nicotiana obtusifolia M.Martens & Galeotti. Desert Tobacco. Perennial/subshrub. *5*

VERBENACEAE–VERBENA FAMILY
Glandularia gooddingii (Briq.) Solbrig. [*Verbena gooddingii* Briq.]. Southwestern Mock Vervain. Perennial herb. *72*

ZYGOPHYLLACEAE–CALTROP FAMILY
Kallstroemia grandiflora Torr. ex A. Gray. Arizona Poppy. Annual herb. *124, 140*
Larrea tridentata (Sessé & Moc. ex DC.) Coville. [*Larrea divaricata* subsp. *tridentata* (Sessé & Moc. ex DC.) Felger & Lowe] Creosote Bush. Shrub. *9*
**Tribulus terrestris* L. Punctureviné. Annual herb. *20*

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LITERATURE CITED

CHRONIC, H. 1983. *Roadside Geology of Arizona*. Mountain Press. Missoula, MT.

FLORA OF NORTH AMERICA EDITORIAL COMMITTEE. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford.

GOULD, F. W. 1993. *Grasses of the Southwestern United States*. University of Arizona Press, Tucson & London.

HARRIS, L. K., J. A. WENNERLUND, and R. B. DUNCAN. 2000. Riparian Vegetation Mapping and Classification, Sonoran Desert Conservation Plan. Pima County Government, Tucson, Arizona. Contract #07-30-H-127196-0100. 56 pp.

KEARNEY, T. H., R. H. PEEBLES, and collaborators. 1960. *Arizona Flora*. 2nd ed. University of California Press, Berkeley.

MUNZ, P. A., and D. D. KECK. 1968. *A California Flora*, University of California Press, Berkeley.

PHILLIPS, S. J., P. W. COMUS, M. A. DIMMITT, and L. M. BREWER, editors. 2000. *A Natural History of the Sonoran Desert: Arizona-Sonora Desert Museum.* University of California Press, Berkeley.

SEINet Portal Network. 2018. http//:swbiodiversity.org/seinet/index.php. (Accessed repeatedly September 2016–July 2018).

SIMPSON, M. G. *Cryptantha s.s*. Taxonomy & Images. Plant Systematics Lab, San Diego State University. http://www.sci.sdsu.edu/plants/cryptantha/cryptax.html. (Accessed repeatably in 2017-2018).

SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. Web Soil Survey. Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/. (Accessed June 2018).

THE PLANT LIST. 2013. Version 1.1. Published on the Internet; http://www.theplantlist.org/ (Accessed repeatedly, August 2018).

UNITED STATES DEPARTMENT OF AGRICULTURE, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, Accessed 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

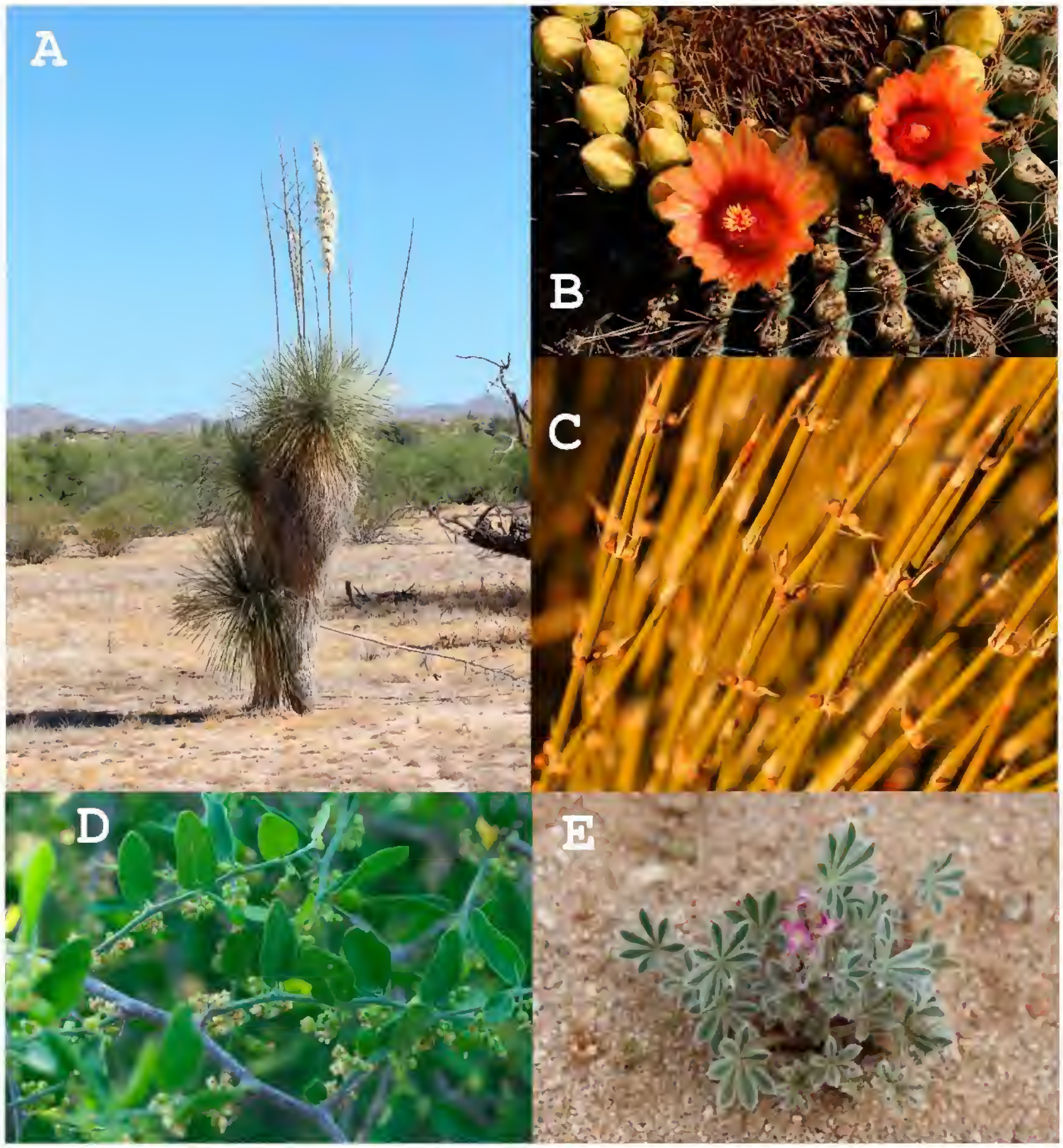

Figure 2. Some plants of the of Canada del Oro Flora. A. *Yucca elata*; B. *Ferocactus wislizeni*; C. *Ephedra trifurca*; D. *Celtis pallida*; E. *Lupinus concinnus*.

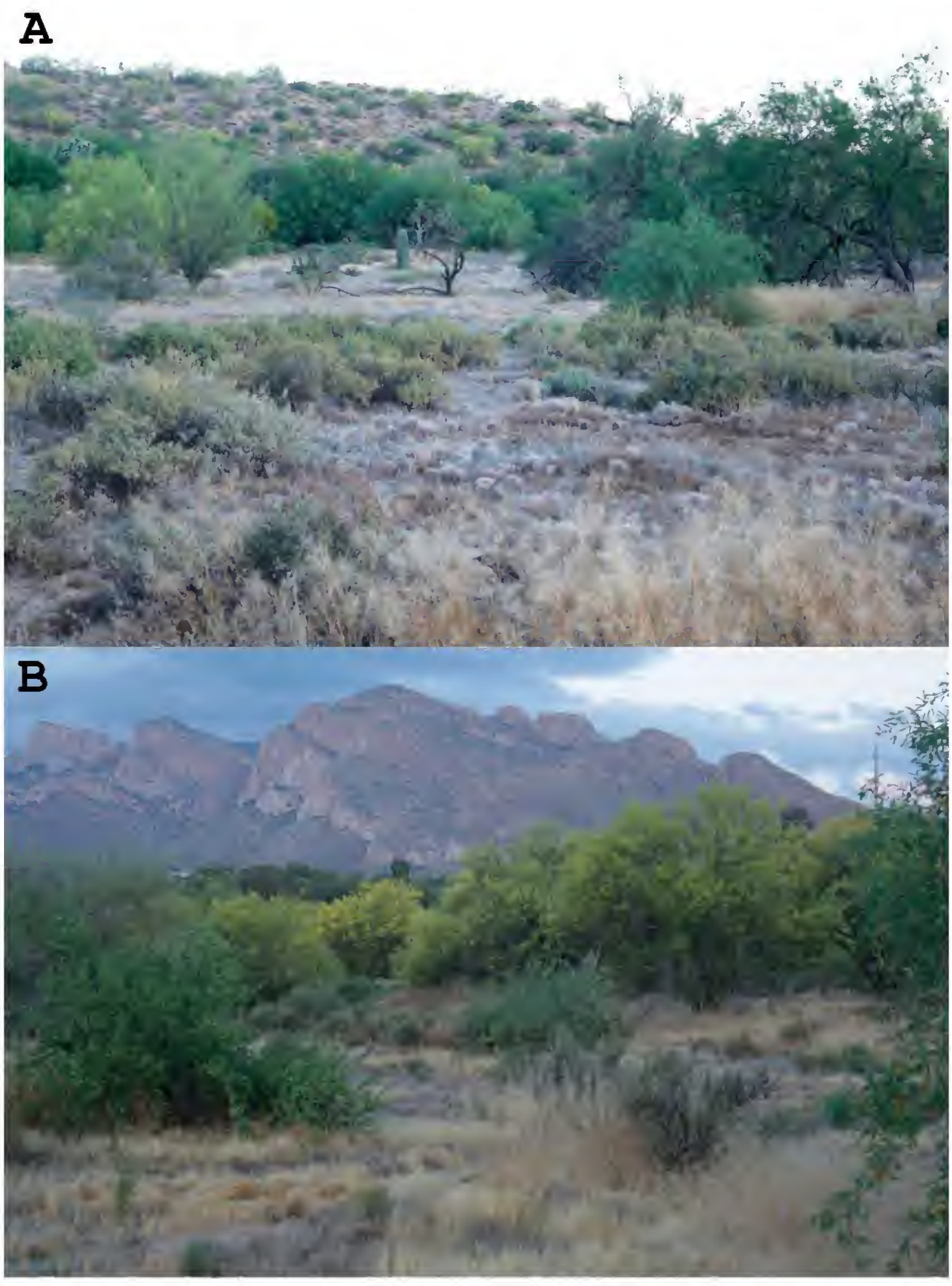

Figure 3. Habitat photos of Canada del Oro. A. Typical view of the study area with *Prosopis velutina*, Cactaceae, and Poaceae. (Hill beyond is not in the study area). B. View of the Santa Catalina Mountains to the east of the study area with several *Parkinsonia florida* in flower.